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SEPTEMBER 3rd, 1942

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Chief Photographer JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

COVENTRY: 8-10, CORPORATION ST., Telegrams: Autocar, Coventry. Telephone: Coventry 5210.
BIRMINGHAM, 2: GUILDHALL BUILDINGS, NAVIGATION ST. Telegrams: Autopress, Birmingham. Telephone: Midland 2971 (5 lines).
MANCHESTER, 3: 260, DEANSGATE, Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.
GLASGOW, C.2: 26B, RENFIELD ST., Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

SUBSCRIPTION RATES: Home and Abroad: Year, £3 1 0. 6 months, £1 10 6. 3 months, 15s. 3d.
Registered at the G.P.O. as a Newspaper.

No. 1758. Vol. XLII | September 3rd, 1942. | Thursdays, One Shilling.

The Outlook

H.R.H. The Duke of Kent

IN time of war the daily publication of casualty lists brings grief to very many families and sympathetic distress to people in general throughout all parts of the Empire, but amidst all this mourning a special sense of shock and horror fell upon one and all at the news that Air Commodore H.R.H. the Duke of Kent had been killed in the crash of a Sunderland. The thoughts of everyone turned in heartfelt sympathy to the beautiful widowed Duchess and her children, to H.M. the King and to all the Royal Family.

Fatal air accidents are, fortunately, rare in these days, and those eminent people whose duty takes them about the world usually, we feel sure, enter their aircraft with a feeling of comfortable security, mingled with thankfulness that they are not obliged to face the perils of travel by sea. Transport by air has, in fact, become almost synonymous with safety. The precautions taken to make everything secure would certainly not be less elaborate when Royalty was among the passengers than when Prime Ministers or Ambassadors have to cross the Atlantic; yet fate has chosen to throw the leading family in the Empire into mourning.

Air Commodore H.R.H. the Duke of Kent, K.G., K.T., G.C.M.G., G.C.V.O.

It is many years since the mischances of war have taken toll of the British Royal Family. In the South African War, Queen Victoria lost a grandson, and some years before that, in 1896, Princess Beatrice lost her husband, Prince Henry of Battenberg, from illness contracted in the Ashanti war. In the last world war the present King and the Duke of Windsor were in action on sea and land, but both survived unscathed.

The Duke of Kent had a long connection with flying, though he was more intimately connected with the Royal Navy than with the Royal Air Force. During the reign of King George V he flew much as a passenger in company with his brother, then the Prince of Wales, covering many miles by air when the two brothers visited South America in 1934. In 1937 he was gazetted Group Captain in the R.A.F., and he was also Hon. Air Commodore in the A.A.F. He was promoted to Air Vice-Marshal, but in 1940, when he began active work with the R.A.F. as Welfare Officer, he relinquished that rank and reverted to Group Captain. Recently he was promoted to Air Commodore. Ever since the outbreak of war he has been engaged in helping the King by visiting and inspecting Service stations, factories, and generally doing the work by which Royalty in this country cheers up fighters and workers and inspires them to give of their best. Had His Royal Highness survived the war, still greater opportunities for valuable work would have lain before him as Governor General of Australia. Australians had rejoiced at the prospect of having the King's brother at Government House. The Duke was starting on a war mission to Iceland when the tragedy occurred which put an end to a life which has been full of useful public duty.

British Production

ONE thing which we British do not produce well is effective propaganda. Probably many neutrals, and Allies as well, have believed that British battles have been fought almost entirely with Dominion and Indian troops, and that the Air Forces of the Empire fly mainly in American aircraft. Mr. Lyttelton's recent broadcast to the United States was timely, and was needed in order to convince the people of that all-important Ally that we in Britain have really been playing an adequate part in the war.

Among other notable figures he told his hearers, in language devoid of all offence, that in the first quarter of this year British factories produced in combat aircraft about twice the weight of American production, and he added that to-day our "pursuit" aircraft are the fastest and most efficient in the world.

The Minister of Supply also told of things which Britain has supplied to the United States, which included A.A. guns, barrage balloons, and aircraft. The last-named item must have sounded to many like sending coals to Newcastle. What he may have meant was that a Coastal Command squadron of Hudsons is operating against U-boats off the coast of America—a loan of experience as well as of lease-lent aircraft.

Air Transport

TWO views of air transport find expression in this issue. Mr. E. C. Gordon England addressed the Institute of Export the other day on the vital importance to the British Commonwealth of Nations of really large-scale air transport after the war. He thought in terms of a fleet of 5,000 aircraft. The journal *Fortune*, in an article which we reproduce almost *in extenso*, reviews the whole subject of air transport in its wartime relation to transportation of men and materials. Our contemporary sums up the position very aptly in the following sentence:—

> "In short, if the air cargo carrier did not exist, it would be necessary to invent it, to end the anachronism presented by a 300-mile-an-hour striking force, based thousands of miles from its home factories, but geared to an eight-knot supply line."

That is, of course, the very essence of the argument for air transport in war. The cost in money matters not. As the article points out, 100 aircraft of the American Volunteer Group were grounded at a critical moment in the Burma battle—merely for lack of solenoids.

As Mr. Devereux pointed out after Mr. England's address to the Institute of Transport, the real bottle-neck is likely to be engines. With so much emphasis being laid on four-engined bombers, huge numbers of engines will be needed, not to mention those required for smaller types, and it seems doubtful that the combined British and American output would be equal to the task of supplying engines for thousands of transports as well.

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Three aircraft carriers steaming in line abreast while on convoy duty in the Mediterranean. A fourth (head-on) can be dimly discerned directly above the stern of the centre carrier. The ship in the foreground is H.M.S. *Eagle* which was torpedoed and sunk after this photograph was taken.

An Italian submarine attacked in the Western Mediterranean by a Sunderland flying boat.

Chinese Successes : Air Fighting in the Pacific : New Japanese Landing in New Guinea : Rotterdam Raided

THE Chinese must have been having a very difficult time since the Japanese occupied Burma and so cut the famous road. Nevertheless, Chinese troops have been scoring some remarkable successes in the Province of Chekiang. The main importance of the operations there is that the province contains the most suitable air bases from which to launch bombing attacks on the islands of Nippon. Gen. Doolittle's raid undoubtedly shook the Japanese, and since then they have been making efforts to occupy the whole of Chekiang so as to avert the possibility of a repetition of that unpleasant experience. The Chinese troops, however, have been advancing and threatening Chuhsien, the largest and most important of the four major air bases. One of the others, Yushan, is already in Chinese hands.

A.V.G. Absorbed

THE strength of the American Army Air Force in China is, naturally, not known, but it must be considerable, and it has absorbed the gallant American Volunteer Group which put up such a fine show in defence of the approach to the Burma road. Further developments are awaited with interest—not least in Japan.

The American Navy Department is, wisely, very cautious in publishing news of the battle going on in the Solomon Islands. Perhaps more news will be available before these words reach our readers. One thing is certain, namely, that the work of their fighters stationed on the island of Guadacanal has been outstanding. On August 23rd the Japanese launched a strong air attack on the island, but the Americans shot down 23 machines and only lost one. Two days later another air attack was attempted by 16 twin-engined bombers escorted by 12 "O" fighters. The American fighters went out and intercepted this force, shooting down seven bombers and five of the enemy fighters, and this time only lost one of their own machines.

In addition to this, up to August 26th twelve Japanese vessels had been damaged, and some of them were left burning. Once enemy destroyers started to shell Guadacanal by night. They were met by dive-bombers (of which Service has not been mentioned) and one destroyer was damaged. Next day an enemy force of transports, cruisers and destroyers approached the island from the north.

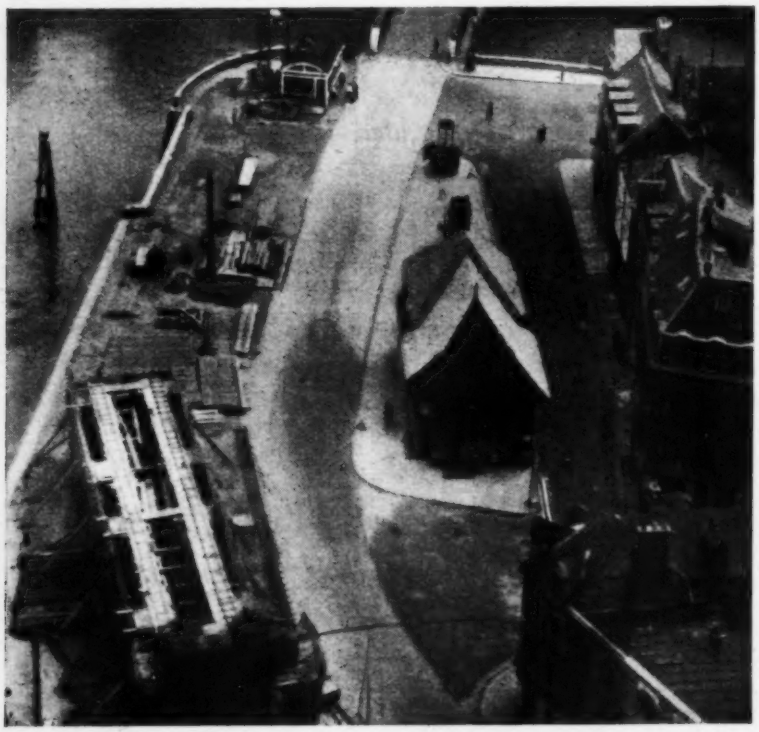
BACK HOME : Mr. and Mrs. Churchill photographed on the Prime Minister's arrival back in this country from his flying trip to Russia and the Middle East. Mr. Churchill is wearing R.A.F. uniform as Hon. Air Commodore of an A.A.F. Squadron.

WAR IN THE AIR

THE PRIME MINISTER'S CREW : The Ferry Command crew of the Liberator I which took Mr. Churchill on his trip to Russia and the Middle East. (Left to right) Capt. W. J. Van der Kloot, O.B.E., Sqn. Ldr. L. Kimber, D.F.C., 2nd Pilot R. Rundels, and Flt. Engineer R. Williams.

This time aircraft of the U.S. Navy and Marine Corps went out to meet them, set one cruiser and a transport fiercely ablaze, damaged another destroyer, and hit other ships. It will be noted that the Americans make no claims which cannot be verified. Some of the other ships may have been sunk, but the American pilots did not see them sink, and so no suggestion of that sort was made. But in another engagement, this time by Allied aircraft based in Australia, an enemy gunboat was undoubtedly sunk by a direct hit by a bomb. There have also been raids by Gen. MacArthur's bombers on various airfields occupied by the Japanese in New Guinea and neighbouring islands, and more than a few enemy aircraft were destroyed on the ground.

The Japanese have, nevertheless, succeeded in making a new landing on New Guinea, this time at Milne Bay, in the extreme south-east of the island. This brings them dangerously close to the shores of Australia, and it may be that this landing is a result of the enemy's failure so far to gain possession of Port Moresby. The extraordinary thing about the landing is that the convoy must have travelled quite 500 miles through New Guinea waters without any air protection. A possible explanation of this daring undertaking is that Japan may not have been able to spare a carrier to accompany the convoy. Precise knowledge of Japanese building is not possible, but an experienced naval writer has calculated that their Navy started the war with nine or ten carriers and that five of these have been lost, the losses amounting to about 60 per cent. of the total carrier tonnage.



LOW RECONNAISSANCE : A photograph of Dieppe waterfront taken by an Army Co-operation Mustang a day or two before the raid took place. It was taken from a height of only 50ft.

Bad weather and monsoon storms to some extent took the place of air protection, and when the Allied bombers attacked the convoy the cloud banks came down to 1,000 feet. It is certain that the air crews would come under very heavy A.A. fire when they attacked from such a low altitude. The heavy bombers claimed to have sunk one transport, probably sunk a cruiser, and damaged a destroyer, losing one machine themselves. That is what the late Major Mannock, V.C., used to call "good arithmetic." As the enemy landed, medium bombers and fighters took up the story and sank six landing barges, besides shooting up large numbers of enemy troops on the beaches. In spite of all this the enemy force succeeded in making its landing. The Allies, who had foreseen this move, had land forces ready to engage the enemy.

To and Fro in Russia

ALL the world has been anxiously watching the great fight for Stalingrad. The Germans claim that the *Luftwaffe* started large fires in that important city, and that was what we should all expect. Reports say that in the south the Russians are badly outnumbered in the air, as well as on

ENEMY AIR LOSSES TO AUGUST 29th.

	Over G.B.	Over Continent	Middle East
Aug. 23	4	0	2
" 24	1	3	0
" 25	1	0	5
" 26	2	0	0
" 27	0	5	0
" 28	3	2	0
" 29	1	2	15
•	12	12	22

Totals: West, 6,299; Middle East, over 4,465.

the ground. Our Allies are at a special disadvantage in the fighting on the western slopes of the Caucasus, where the Germans are pushing for the naval bases on the Black Sea. The Russians are defending the ridge of mountains, and there they have few or no airfields, whereas the Germans can make any number of landing grounds on the plain round the Kuban River. Bombing, however, is less effective in mountainous country than it is on the flat. The defenders can find plenty of cover, and also storms over mountains seriously hamper the work of the airmen.

In the meantime General Zhukov has made a great advance to the west of Moscow, and in furious fighting has forced his way forward for some 30 miles. The town of Rzhev was his object, and he has attacked from all sides.

Despite preoccupations elsewhere, the Russians have made several more bombing raids on Germany, attacking Berlin, Danzig, Königsberg, Stettin, and other places.

The West Air Attack

THE Americans and the R.A.F. have been hammering hard with bombers in the west. An American foray on Rotterdam was specially notable because the bombers were escorted by Spitfires, which may have been fitted with extra tanks to give them the range. Another similar raid was made by Fortresses on Méaulte near Albert, where airframes were made for the Germans. Again Spitfires provided an escort, and this, too, was an unusually long flight for the fighters.

Bomber Command has made one of its "concentrated" raids on Cassel, where locomotives and other war material are manufactured. On the same night heavy bombers flew to the Polish port of Gdynia, which meant a return trip of nearly 1,800 miles, and then found clouds over the place, and had great difficulty in locating their targets. Saarbrücken was visited on another night, and other places attacked have been Frankfurt, Wiesbaden, Nuremburg (where there is a diesel engine factory), and Wevelghem airfield, near Courtrai.

BRITISH AIR LOSSES TO AUGUST 29th.

	Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
Aug. 23	1	0	0	10
" 24	0	16	2	
" 25	0	1	0	
" 26	0	0	0	19
" 27	0	31	11	
" 28	0	30	1	
" 29	0	2	1	
	1	80	15	29 (6 pilots safe)

Totals: West 4,599; Middle East, about 1,625.

ONE-FLIGHT FIGHTER: S.S. *Empire Tide*, a merchantman with a Hawker Hurricane waiting on the catapult. Used for convoy protection, the fighters are unable to land on the ship again, and the pilot bales out when his fuel is exhausted. The Hurricane is lost, but more often than not the enemy have to pay full price.

Later News

SINCE the first paragraph of this article was written, the Chinese have announced that they have completed the capture of Chuhsien. The Japanese had wrecked the buildings and runways on the large airfield there, but doubtless it can soon be made usable again. In addition the Chinese have also captured Lishui, one of the other important airfields in Chekiang Province. The Japanese islands are now within reach of American bombers based in China.

The Japanese have also fared badly in the Solomons and in New Guinea. The reinforcements which they landed at Milne Bay do not seem to have amounted to much. They arrived, not in transports, but in a cruiser and eight destroyers. An attempt was made to bomb these on their way, but the bad weather enabled the enemy to get through. The Allied ground troops have, however, rapidly cleared the enemy out of the bay with heavy loss. All the enemy's heavy equipment, including tanks was lost to him.

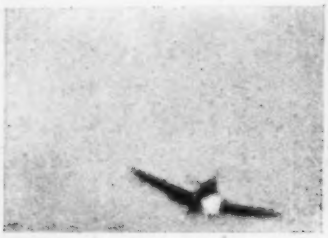
Meanwhile the Americans have been doing very well in the Solomons. The Japanese fleet which tried to launch a counter-attack retired before the attentions of the U.S. aircraft. The Americans have occupied six of the islands in the group, and proceeded to hunt isolated parties of the enemy. A flotilla of three large destroyers and one small one tried to bring support to one of these parties, but was spotted from the air and was promptly attacked by all available aircraft. Patrol aircraft began the attack, and then dive-bombers arrived and finished it off. One of the large destroyers was sunk, another was probably sunk, the small one was set on fire and crippled, and the fourth one stood not upon the order of its going, but went.

THE FALSE ALARM: Killer whales in the Bay of Biscay which made a Coastal Command aircrew think they had a submarine target such as is only dreamed of.

THROUGH th R

Cine-camera Sh ken by Our Fight ver Occ

(1) A very short story in two pictures of an attack on a small factory during a daylight sweep.



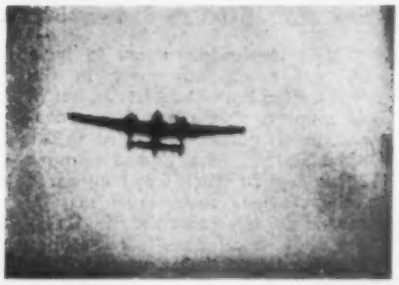
(2) Enemy war factories, power stations and gas holders all receive attention from bomb-carrying and cannon-firing fighters carrying out sweeps over the Continent. Here is seen an attack by a cannon-firing Hurricane on a factory and a gas holder.

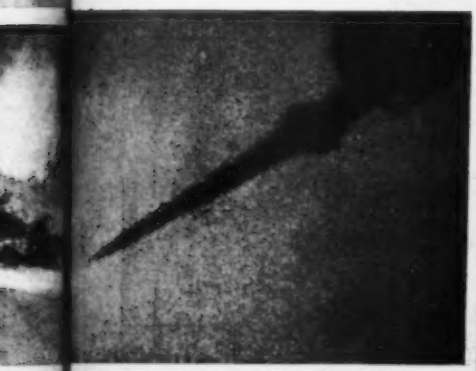
(3) Enemy aircraft is attacked. (From the top downward). The Me 109 plumb in the gunsights ; a hit on the engine ; the machine bursts into flames ; the last picture as the action is broken off and the enemy plunges to earth.

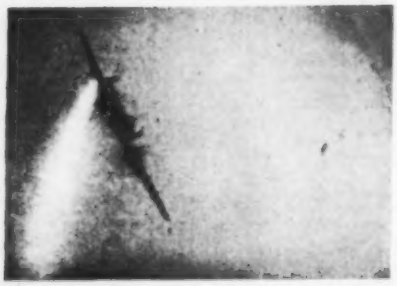
th REFLECTOR SIGHTS

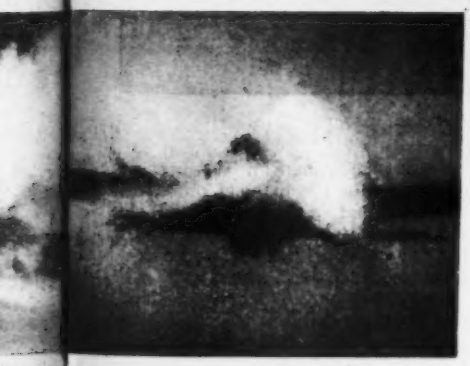
ken During Air Fights and Low-flying Attacks ver the North Sea and Occupied France

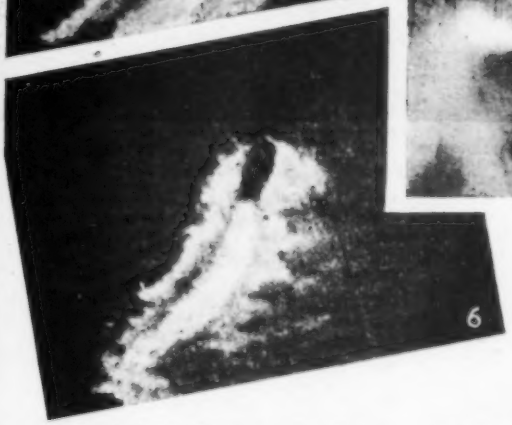
ACH fighter carries a 16mm. cine-camera nstalled in the leading dge of the wing. The hutter is operated by the ame press button as the un trigger and photo- raphs the attack as seen y the pilot through his eflector gun sight.

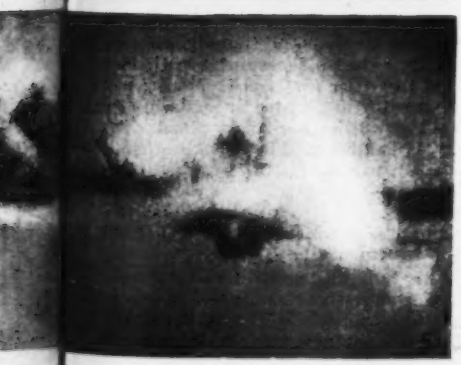












(4) Constant attacks on enemy railways compel him to use coastal shipping. These, also, come in for their fair share of strafing by our cannon-armed Spitfires, Whirlwinds and Hurricanes. These four stills from a combat film, as it is called, show the run-in and attack on a heavily-protected supply ship.

(5) The end of a Heinkel III. For absolute point-blank range—only about half of the machine appears in the sights—a Spitfire's eight guns pour projectiles into the enemy at the rate of 9,600 rounds per minute to set both engines on fire.

(6) German E-boats are difficult targets to hit. They carry heavy defensive armament and can zig-zag at high speed. It is nevertheless evident from this sequence of three photographs that this particular E-boat is having an unpleasant passage through a hail of machine gun fire from a diving attack by one of our fighters.

(7) From this last series it is possible to get something of the thrill a fighter pilot feels when he makes a kill. It shows a Messerschmitt 110 from the time the guns open fire to the time when it turns over on its back with smoke pouring from both engines.

STRESSED-SKIN PIONEERING

Great Britain's Claims in This Important Field of Development

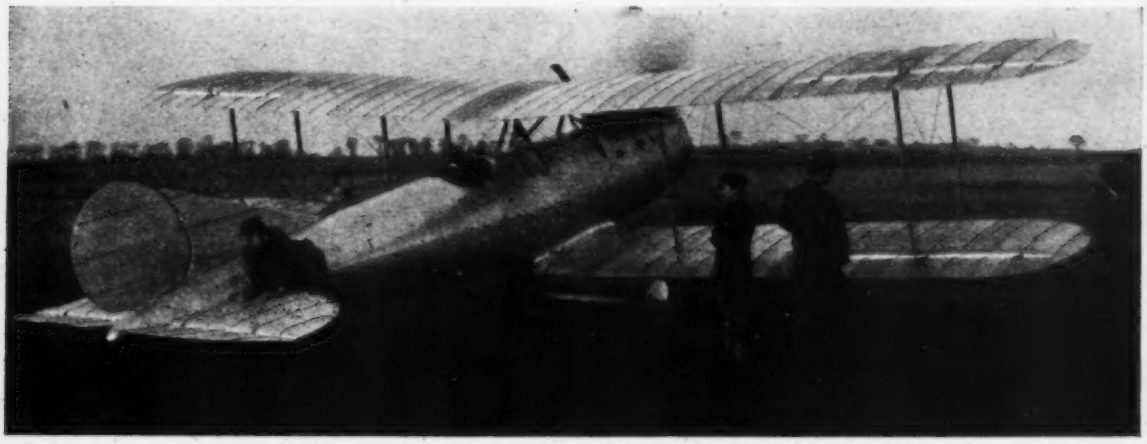
By OSWALD SHORT

THE impression seems to have got about, not only in the United States of America but in this country, that stressed-skin construction of aircraft originated in the United States. As a typical example we may take an article which appeared in the August, 1942, issue of *The Readers' Digest*, under the title "Plywood Flies—and Fights." The following statement occurs: "In 1930 John Northrop's famous 'Alpha' model of an all-metal aircraft set the stage for a wholly new type of construction in the U.S. Engineers took it up with a whoop. Soon came the big all-metal transports, and afterwards the 'Flying Fortresses' and fast all-metal pursuits, etc. That revolution shook Europe, also," etc.

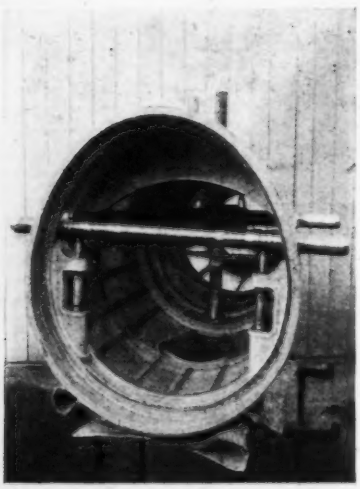
These statements obviously apply to stressed-skin light-alloy construction. Even in these times it is necessary to keep historical facts in order.

It was the "Silver Streak" which created the revolution in design of aircraft. First in England, then in Europe, and lastly, I believe, in the U.S.A. Now the system is used throughout the world.*

Mr. Hugh Oswald Short, F.R.Ae.S., is one of the pioneers of British aircraft constructors. With his brothers Horace and Eustace he began to build heavier-than-air aircraft in 1908-09 and has been building them ever since.



The first stressed-skin biplane, the Short "Silver Streak," was flown in 1920.



Fuselage tail portion of the "Silver Streak." Picture taken late 1919 or early 1920.

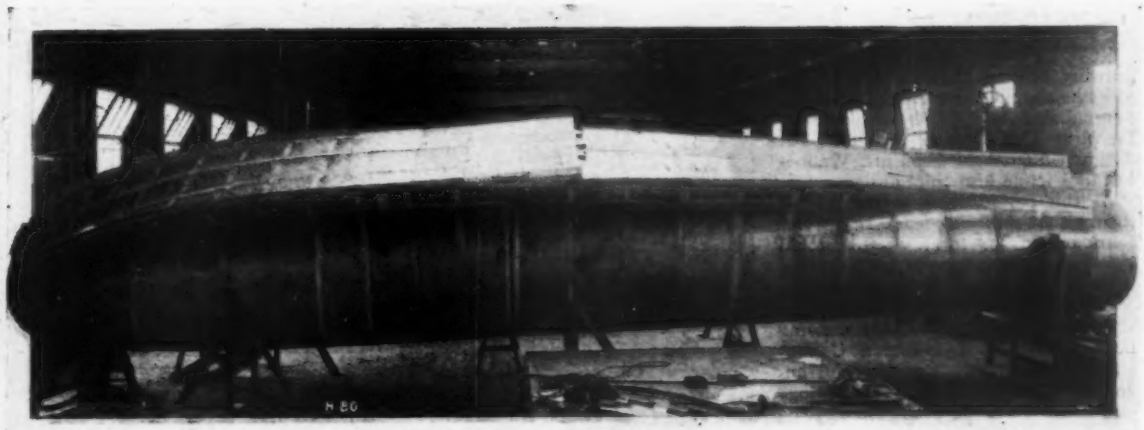
The writer was the originator of stressed-skin all-metal construction, as carried into practice, in the year 1919. Until that time there was not a stressed-skin fuselage in the world. It was exhibited at Olympia in July, 1920. I had been laughed at by my rivals in the aircraft world, but *The Engineer*, July 16th, 1920, praised it in glowing terms as an engineering structure in the full sense of the term, and in its show report, on July 22nd, 1920, *Flight* said: "It goes without saying that the Short all-metal machine is not only the most interesting on this stand, but *the feature of the show*." (the italics are mine).

The first to approach me at Olympia were certain officials attached to the American Embassy. They informed me that the American Government would buy the machine. I preferred, however, that it should remain in England, and one day later I was told that our own Air Ministry would purchase it, which it eventually did.

The writer moved quickly in those days and applied the system to the construction of a hull with a fluted bottom as far as the main step. The flutes were parallel to allow the water to escape, and greatly strengthened the hull for external pressures. With an order from the Air Ministry, this was fitted to the antiquated superstructure of a F.5 wooden-built flying boat. It flew well and proved its strength when, in rough water near the west coast of France, the machine was stalled, and fell into the water from an estimated height of 30ft. Not a rivet leaked after that experience.

This hull was built in vertical sections, which were then riveted together to form the whole structure, something like the new method of building

* An article by the Editor on the pioneer work of Short Brothers appeared in our July 16th issue, in the Series: *Ahead of their Time.*



This fluted all-metal hull was built to replace the wooden hull of a F.5 flying boat, the wooden superstructure of which was retained.

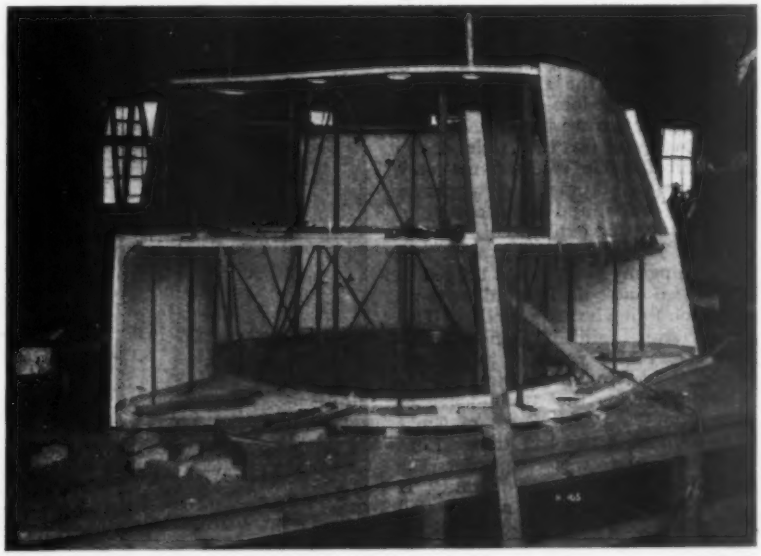
STRESSED-SKIN PIONEERING

ships in the U.S.A. It had followed upon the manner in which the "Silver Streak" was built, as photographs herewith will show. Before 1925 we had built the "Satellite," a monoplane without spars passing through the fuselage. This machine was all-metal except for the wing covering. The Short "Singapore I" was well under construction.

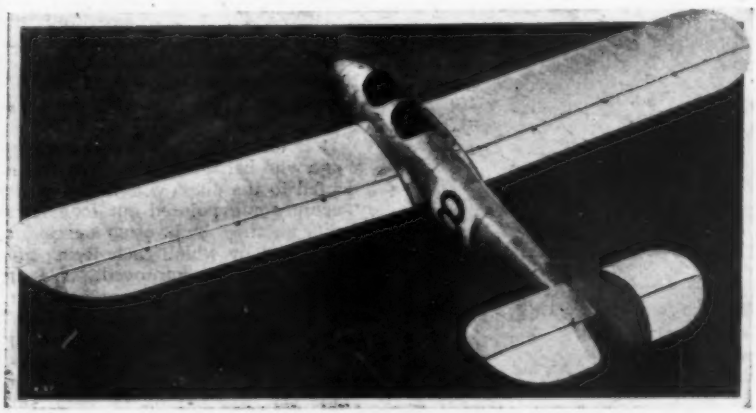
U.S.A. Firms Interested

In 1924 the writer went to the U.S.A. and exhibited to various American constructors drawings and photographs of all we had done to that date. Included in these photographs is one of a drawing of a twin-engined twin-float seaplane dated 1921. The writer had tried to get an order from the British Air Ministry for this machine over a period of two years, but had failed in that object.

I tried to sell the design in America and nearly succeeded. At the Navy Department in Washington Commander Hunsaker gave me a letter of introduction to two American aircraft



"The metal hull for the F.5 flying boat was built in vertical sections, something like the new method of building ships in the U.S.A."



The Short Satellite was built for the Lympne light plane competition of 1924. It had a 30 h.p. Bristol Cherub engine and was of stressed-skin construction. In addition to the smooth skin it was notable for its full-span flaps.

constructors, stating that the Navy Department would place an order for its construction if either of the two constructors would build it. The constructors were interested and absorbed with great interest all I had to show them, photographs, drawings, etc., but neither would take on the work.

Looking at this machine, and the date when it was first outlined, it appears a practical proposition suitable for carrying bombs and torpedoes. It is a pity that it was not built and tried out.

The writer only claims that he originated these ideas and made the first rough sketches of the form of the machines, and some of the details such as the construction of spars and floats. It needed a large staff of sub-designers and draughtsmen to carry the designs to completion. Up to this time Mr. Webber was in charge of the

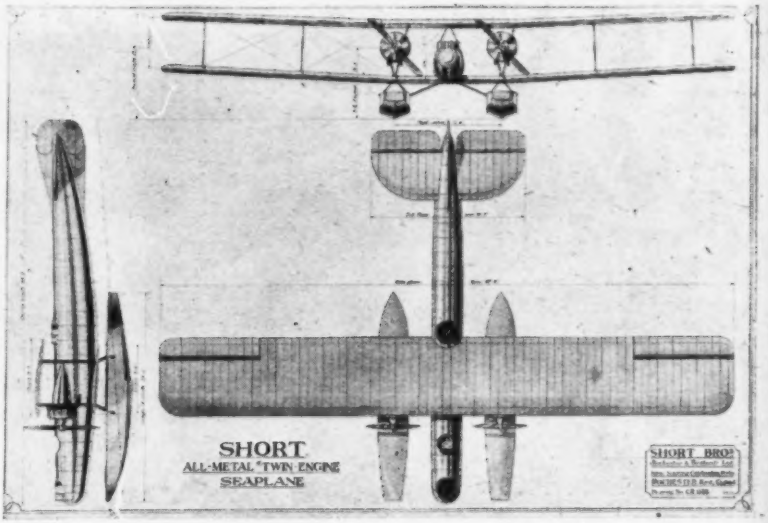
STRESSED-SKIN PIONEERING

drawing office staff, and many good ideas he supplied, improving upon my original sketches. Whilst he was with the firm I had come to know Mr. Arthur Gouge, and when Mr. Webber left us I made him chief designer.

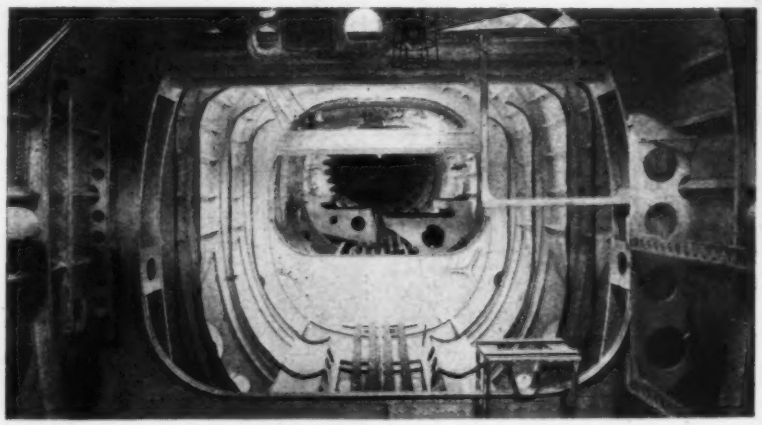
At this period there still existed a theory that no flying machine heavier than 10,000 lb. total weight would show any advantage in performance because of increased structure weight. I thoroughly disbelieved this theory and decided to build a flying boat with six Rolls-Royce Condor engines, then the most powerful engine available. Together Mr. Gouge and I discussed the proposition. The engine mounting was original, two engines in tandem being carried on single struts. The ideas were passed on to Mr. Lipscomb and his staff of designers. When the drawings were completed we took them to the Air Ministry and tried to get an order for the machine, but failed, although it was backed by the D.T.D., at that time Air Commodore Chamier.

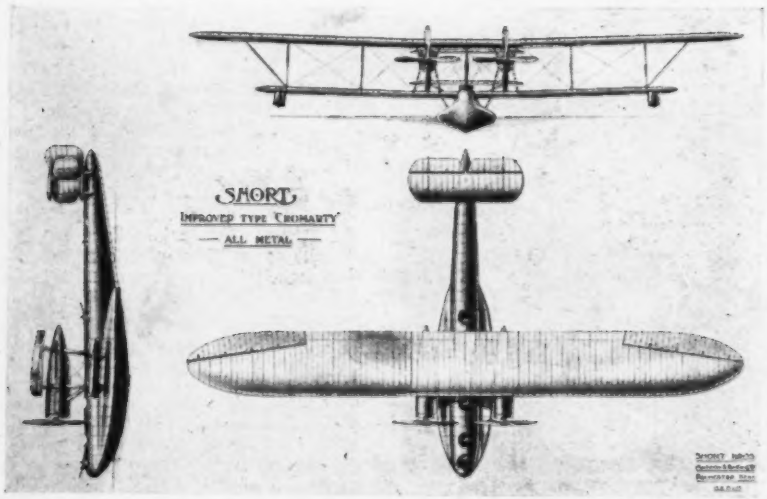
I then went to see the present Lord Trenchard, who was then Chief of the Air Council. He received me very kindly, whilst I urged the merits of big flying boats, and the necessity of building one for experience. Soon I felt that I was not talking well, and not making my points, so I begged to be excused and said I would write an article on flying boats generally. This I did, and I still have a personal letter from him which I prize very much. I had convinced him!

Before leaving the Air Ministry to reorganise the Police Force of Great Britain, one of the last things Lord Trenchard did was to order the "Sarafand" from my firm. It weighed all-up about 73,000 lb. and was successful from its first flight.



This all-metal twin-engined twin-float seaplane was designed in 1921 and the drawings shown to American aircraft constructors in 1924, when Mr. Short visited the United States. (Below) Picture of first "Singapore," shown to Americans in 1929.





The improved all-metal Cromarty was never built (the first Cromarty had a wooden hull), but drawings were taken to America in 1924.

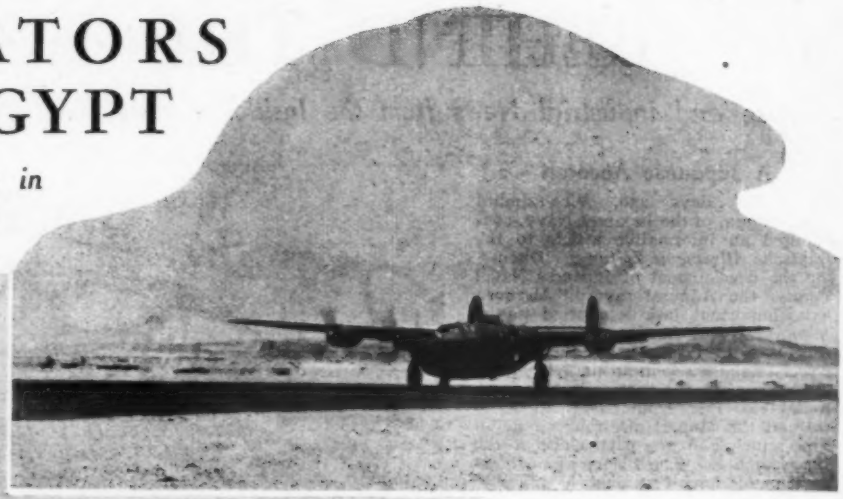
The battle for the big all-metal flying boat was won.

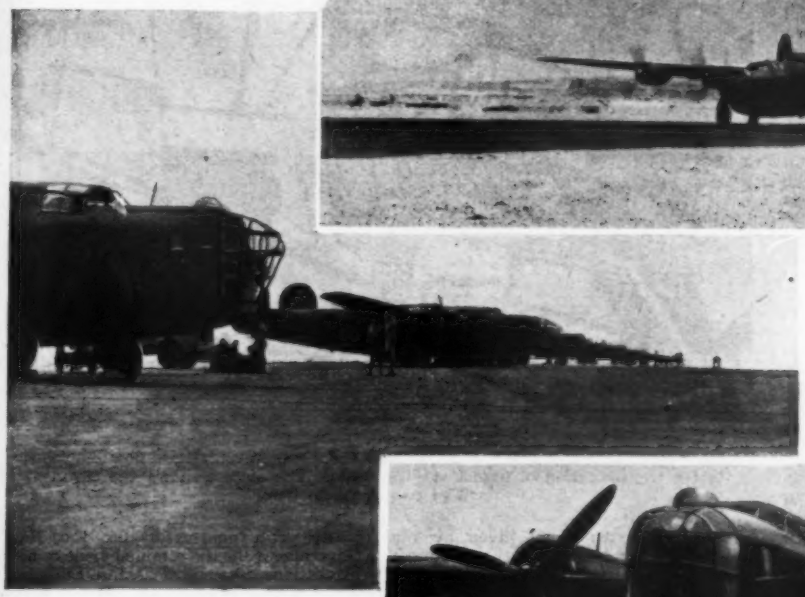
When I look now upon the "Sunderland," the "Stirling," and the "Flying Fortresses," etc., etc., I take some pride, not immodest, I hope, in the fact that, so long ago, I laid the foundation which has brought them into existence.

It is too difficult to mention all by name who helped in this. We are indebted to the pilots who first flew the machines and pointed out to us such faults as they had, often suggesting the means by which their flying properties could be improved. We are indebted to the managers and foremen in the workshops who built them so quickly, devising their own jigs. It is rather curious that the latter, almost to a man, were carpenters by trade (5). They took to metal construction as a duck takes to water. Many of them are still with us now in more important positions.

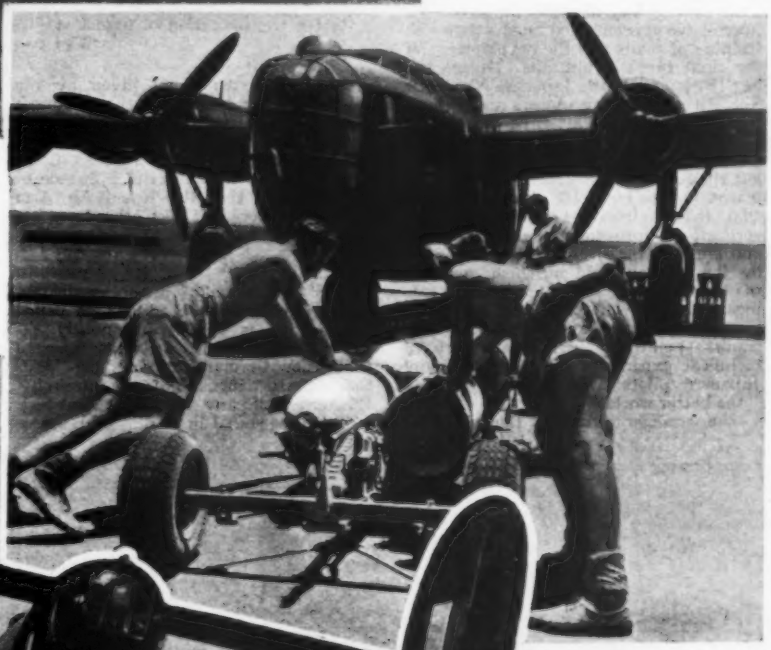
LIBERATORS OVER EGYPT

Anglicised Heavies in Western Desert

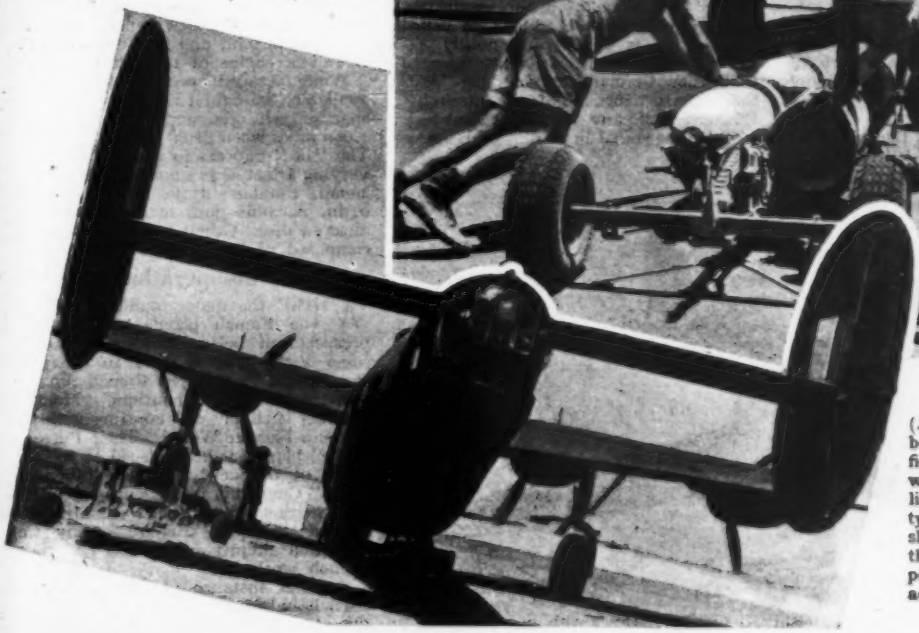




(Above) One of the R.A.F.-operated Liberators taking off from a desert airfield. In the Middle East the long range of the B.24 makes it an almost ideal type. The targets may be as dispersed as Italy, Rumania or Greece and to have aircraft which are easily movable from one front to another is a very great advantage.



A useful line of tricycle heavies on the desert. From the black-painted underside it is presumed that they are being used exclusively for night work. A new feature is the astro dome over the nose.



(Above) The Liberator's bomb racks have been modified to take British bombs which are of a better streamline form than the American types. (Left) This rear view shows how we have armed the tails with four-gun power-operated turrets in accordance with our usual practice.

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

A Japanese Account

A FEW days ago, Vice-Admiral Nomura, of the Japanese Navy, contributed an informative article to the *Deutsche Allgemeine Zeitung*. Discussing the development of Japanese Naval Forces, the Admiral says: "An even more important task is allotted to the Japanese Naval Air Force. The Naval Air Force must supplement the striking power of the Navy in an undivisible co-operation with the fleet. One may say to-day that there cannot be a sea battle without the support of strong air units. This principle applies particularly to the Japanese fleet. The theory of an independent air force can never be put into practice if Japan's geographical position and the resulting strategic requirements are paid due consideration. The Naval Air Force is an integral part of the fleet.

"The starting points of the wide-ranged actions of the Japanese Naval Air Force are the aircraft and seaplane carriers and coastal bases from which naval air squadrons operate. The three branches of the Naval Air Force are always closely co-operating with the fleet in order to secure the operational sea and air superiority. The endeavours of the Japanese Air Force have concentrated on the thorough training of pilots and the development of the right types of aircraft. During the last twenty years the Japanese Naval Air Force has lost many officers and ratings for this purpose. This gave the outside world the impression that Japan's naval aircraft are not much good. Japan has left the world in this belief. In fact, the reason for the high rate of accidents was that many aircraft types needed still very great improvements. Such mistakes and faults of the aircraft were discovered by the constant and unselfish sacrifices of lives of Japanese officers and ratings. . . ." This is a first statement emanating from a Japanese source fairly frankly pointing out how the lack of technical experience has sent so many Japanese pilots even in peacetime to "the better world."

The strategic reasons for the expansion of the Naval Air Force given by the Admiral are, of course, not the real ones; it is well known that Japanese shipbuilding interests considered the Naval Air Force as their monopoly, and it was largely due to the powerful influence of this industry that the Naval Air Arm has gained precedent over other branches of Nippon's Air Forces.

The Fieseler-Storch, a widely used German Co-operation aircraft, is now employed for the transportation of urgent surgical cases. The picture shows the arrangement of two bunks in tiers.

Nazi Rubber

THE cultivation of a rubber-yielding Caucasian type of dandelion called Kok-saghyz is being continuously expanded by the Nazis. It is now reported that a new German company, the "Ost-Gesellschaft für Pflanzenkautschuk" (Eastern Company for Plant Rubber), recently registered in Berlin, is to act as trustee and contractor for the Nazi Government for the establishment of new plantations in occupied Eastern European districts of Russia.

THE "OO" FIGHTER: The Mitsubishi OO Fighter powered with one Nakajima engine of 1,100 h.p. is one of the newest aircraft of the Japanese Naval Air Force.

"OO"

ONE of the most recent types employed by the Japanese Naval Air Force in various engagements in the Pacific War Zone is the Mitsubishi oo fighter. This is a development of the "Navy o" Fighter, which had a speed of 315 m.p.h., while the new type is credited with 340 m.p.h., and is powered with a Nakajima engine of 1,100 h.p.

While detailed specifications are not available, the fighter is known to have a span of 34ft. 4in. and a range of over 1,600 miles when fitted with extra tanks. The "oo" appears to be equipped with varying armament; some types have two 20mm. cannons in the wings and two 0,3in. machine guns firing through the airscrew disc. Others have an armament composed of four 20mm. cannons.

Co-operation

WHILE the underground struggle of the French people goes on, the prospects of better dividends prompts some Vichy industrialists to "exploit the market": thus the French S.A. de Constructions Aeronautique Morane-Saulnier is closely collaborating with the German Fieseler Werke. Their Puteaux (Seine) plant has been placed at the disposal of the newly formed "Fieseler-Paris" Company, and is engaged on the construction of Fieseler aircraft. At present Fieseler "Storch" Army Co-operation aircraft are produced in these French works.

Another instance of German use of French industrial resources is the "co-operation" between the Amiot Company and some Nazi aircraft interests.

Topics of the Day

RELATIVITY—I

Larger and More Complicated : Some Comparative Impressions : A Matter of Reflex

IN one of his plays, Bernard Shaw (perhaps by way of publicising the Life Force idea) suggested that there was no reason at all why the newly born should not appear with a great many more automatic reflexes than those involved in breathing, heart-beating, and so forth—that there was no reason, in fact, why the human animal, in its embryo form, should not repeat a little more of its life history, and learn also to read, write, do sums, and ride bicycles, once these accomplishments had become normal in the later life of the child's forbears.

Certainly, the appearance, by mutation or otherwise, of infant prodigies suggests that, racially, we might be learning by experience, though the repeated appearance of wars as a means of settling differences (or for any other purpose) hardly suggests that such an optimistic idea can be treated seriously. Though, in our own experience, it is certainly a fact that things are more easily learnt generation by generation—or, at least, those things which involve purely reflex efforts of the muscles, or, presumably, of the brain. My grandfather, for instance, had the greatest difficulty in learning to ride a bicycle; my father found it quite difficult enough; I found it fairly easy; and our children seem to know all about it as soon as a velocipede is produced for their inspection. Similarly, where brain reactions are concerned, our grandfathers struggled with the intricacies of the steam engine (which entirely defeated our grandmothers—though they may have been pretending or just lazy), while we find it a fairly simple matter to follow the workings of a supercharged aircraft engine, or anything else of the kind.

Pre-Natal *Ab Initio*

Since the cells which make up our bodies can be "taught" things, there is no reason at all why the spermatozoa or what-not should not carry on information about reading an aerodynamics just as easily as they appear to carry on the information about making the heart beat and the lungs breathe. Evidently the second accomplishment is, historically, a later one, since I understand that new-born babies have to be smacked before they can learn it—though this may merely be an old midwives' tale. By way of further digression, it is a fact that really excessive use of the conscious brain can cause the automatic brain to fail in its work; during really tremendous concentrations one is liable to forget to breathe until the lack of oxygen makes itself felt and the blood screams a message to the head telling it to stop concentrating on relativity, or whatever, for a moment while the reflexes get on with their job.

Maybe our children's children will learn to fly more easily than we do. The worst of it is that when we come to really large aircraft it is not so much a matter of flying as of applied mechanics. But that is where the reflexes come in; by the time we reach the stage of flying pantechnicons we have brains enough to spare for the job of thinking what to do next while the reflexes cope quite adequately with the mere business of flying as such. In due course, I suppose, the "thinking of what to do next" becomes subconscious, and we are ready to tackle still more complicated aeroplanes.

Certainly, when we jumped from our basic trainers—or, in the case of more mature pilots, from our private aircraft and low-powered peacetime oddments—to things like Harvards, Masters and Oxfords, we were still learning to fly and to think at the same time. I remember wondering how I could ever find time to map-read or work things out while coping with one of these "modern" things, yet within a few months it all seemed fairly simple. The flying *and* the control drill had become subconscious, and the Hurricane had taken the place of the Tiger Moth as the runabout and light (*sic*) aircraft for weather-testing or for trying out new satellite landing grounds. The Hurricane, with its undercarriage and flap controls, its constant-speed airscrew and its erstwhile air of complication, had become second nature, and it required no very conscious thought for its successful conquest.

From Bus to Bike

It had become part of oneself, just as the Moth and the Hawk had built themselves round one's consciousness in earlier days. Yet for the first few hours the Hurricane had felt a heavy, complicated and noisy separate entity—something to be treated with a very great deal of caution. Approaches were made in a straight line, on motor, after all the drill had been carefully carried out, checked and rechecked, with one eye on the landing ground and the other on the A.S.I.

And so it goes on. I remember, in the days before the war, sitting in the first pilot's seat (or flying in the second pilot's seat) of commercial machines a great deal smaller than, for instance, a Wellington, and wondering how the chaps managed to cope with it, and whether such a large machine, with such an awkward seating position, could ever feel part of you in the way that all good machines become one with the pilot. Yet it happened in due course. For the first few hours the Wellington or the Whitley or the Boston felt strange and awkward; take-offs and approaches were made according to the book; you, a small, miserable little fellow, were sitting surrounded by almost uncontrollable machinery, guiding it all by an almost superhuman feat of intelligence and skill. It was a separate entity, large and frightening.

Gradually the pantechnicon became a buggy, the reins were held more lightly and confidently, and eventually you were making spectacular engine-off approaches, while lazily lowering the undercarriage and flaps, and terminating with a few light-hearted swish-tails. It had become an extension of one's own consciousness, wings to one's own back, just as the little fellows had, hours and hours ago.

Cockpit Drill

It takes time, and, for my part, I am eternally grateful for the good old C.F.S. drill which is so all-embracing. However well one knows an aircraft, however many hours one has put in with it, however one whistles and sings while making an approach—one can always find time to run quietly through the H.T.M.P.F.G. or H.U.M.P.F.G. (depending on whether a take-off or an approach is contemplated) line of business. "Hot-tempered-member-of-Parliament-flaps-his-gills" was how I originally remembered the first; now, I suppose, even that Pelman scheme is almost reflex. Hydraulics (now nearly always unnecessary), trim, mixture (including the petrol cocks and the throttle tightener), airscrew pitch, flaps and gills (or radiator shutters). After going through that lot, the pilot has a pleasant feeling that nothing has been forgotten—and peace of mind is half the battle where flying is concerned.

Other people, who have necessarily had to teach themselves how to run through the essentials in a modern type, have devised their own systems, but this one seems to be as good as any. Of course, errors *can* be made. It is even possible to run through the whole lot and to do nothing whatever about it. As a more than interested passenger in a large aircraft I once watched a very experienced pilot (in the excitement of flying a new type) say "Pitch" to himself in a loud voice, touch the levers, and pass on to

RELATIVITY—I

the flaps; the c.s. airscrew controls were far from being in take-off pitch, but by touching them he had somehow covered the matter in his own mind.

A few more things must be added in the case of "giant bombers," though the principle remains unaltered. For instance, the modern aircraft engine gives so much power at take-off and pulls so much fuel out of the tanks that the ordinary mechanical fuel pumps can actually suck the pipe-lines closed and even collapse the tanks when all engines are giving take-off power; auxiliary fuel pumps have been installed to *push* the fuel along from the other end—so we have fuel booster pumps to turn on before departure and arrival.

Then, again, control surfaces offer such a large area in the case of large aircraft that it is very much simpler to leave the controls locked until the actual moment of take-off; unlocking must not therefore be forgotten. And tail-wheels, too, can be locked with advantage in the fore-and-aft position, so that there is a check on the swing both on take-off and after landing; when such a control is included, here is another item for the mental guide. But the basic things are covered with the original scheme, and it is only necessary to think ". . . and what next?" instead of eyeing the entire control system with a worried look.

Even fuel or hydraulic booster pumps and tail-wheel locks in time become second nature. And after a few hours the enormous cabin, with the complicated bank of controls in the centre, the screen a couple of feet or more away, and the nose running off into the distance, the heavy and comparatively unfeeling controls, the sight of a row of engines on an apparently silly little wing several miles behind and below your seat, and the sound and sight of an army of people wandering about the place are equally familiar. The twenty-five ton, six-thousand horsepower affair becomes just a pair of rather heavy wings on one's shoulders. Everything is under control.

The novice, with the awful feeling that he is being flown rather than flying the thing, and the fear that something might happen which is not understood, and which cannot be coped with, slowly becomes the casual pilot who knows that he is always the master even if two of the four engines stop and the hydraulics blow up.

Just a matter of relativity and habit. The Tiger Moth felt just as uncontrollable and strange once upon a time.

INDICATOR.

BOOK REVIEWS

"Aircraft Instruments." By J. Riley. N.A.G. Press, Ltd. 1s. 6d.

INFORMATION on most of the instruments fitted to the modern aircraft is given in this paper-bound booklet, and although the author does not claim to have treated the subject exhaustively the contents will unquestionably be of considerable value to the student. Mr. Riley is an accomplished technician on instrument design and construction, and he has dealt with his subject in a simple and straightforward manner in describing the functions of the various instruments and the basic principles of their design.

Fighting Lights. By Lce. Sgt. John E. Cross, R.A. (Williams and Norgate. 1s. 6d. net.)

THIS is a small paper-covered book with a lot of interest inside the covers. Sgt. Cross was a journalist, and he writes well. His story is that of life in a searchlight battery (these units now belong to the Royal Artillery, not, as formerly, to the Royal Engineers) and many people must have wondered what sort of a time these gunners have had since the war started. This book answers the question. They have had lots of hardships and discomforts at times, especially in winter, when they were under canvas, but they have had good times, too. Gradually his battery came to feel itself a unit, and to take a pride in itself. "When the inside story of the R.A.F. night fighter is told," he writes, "searchlights will be found to be credited with a considerable portion of their success." He adds that the enemy can have no knowledge of our new types of defences, and says that "he will receive a great surprise on the next occasion when he tries to carry out full-scale night bombing raids on this country." He believes that the women of the A.T.S. will take over some of the searchlight areas, and considers that women are by nature more suitably equipped to deal with the intricate manipulation of radio-location and the delicate adjustment of range-finders and height-recorders.

One thing this author could never understand, namely, the frequent moves of his unit and others from one county to another. Civilians (including many old soldiers) cannot understand it either, and sometimes wonder whether the War Office is not abusing the almost complete monopoly of railway transport which has been entrusted to it.

"Wits' End." By John Moore. J. M. Dent and Sons. 7s. 6d.

IN an autobiographical note the author says that he joined the Fleet Air Arm because he was an amateur pilot before the war and liked the sea. "However," he adds, "having now flown for nearly a thousand hours, almost all of it over the sea, I am determined, when the war is over, never to have anything to do with aeroplanes or the sea again."

Probably most of the R.N.A.S. pilots of the last war said much the same thing before November, 1918—and many of them lived to become some of the best civilian pilots of the post-war years.

John Moore was known as a novelist before the war, and this is his first book since he joined the Service in September, 1939. His chief characters are Anthony, a Fleet Air Arm pilot, and Tessa, a driver in the Auxiliary Ambulance Service, and while their charming love story is the book's main theme, the Service background against which it is told is so authentic in atmosphere that one can easily forget that the actual incidents described are fictional.

There is much admirably descriptive writing in this book, as when Tony flies in his Swordfish (the old "Stringbag") above Dunkirk and sees beneath his wings the procession of little ships "crawling through the wrinkled sea." There is plenty of virile Service humour, plenty of excitement, and, inevitably, grim tragedy.

This is more than a novel; it is a sincere tribute from the author to his comrades, especially those who "didn't get away with it."

Ark Royal. The Admiralty Account of Her Achievement. H.M. Stationery Office. 9d. net.

NOT long ago there was reviewed in these columns a book with the title *Ark Royal* written by Sir Herbert Russel in collaboration with Cdr. Pursey, R.N. Now the Admiralty has published its own account of the career of this famous ship, and was naturally in a position to give more details than appeared in the private venture. In particular, this story brings out many of the difficulties with which a carrier has to contend, which would not occur to the ordinary landsman or airman, though they are easy to understand when set before him.

Things were especially difficult during the chase of the *Bismarck*. The Atlantic was so rough that the rise and fall of the "round down" at the after end of the flight deck was no less than 56 feet. The *Ark Royal* had been ordered to send off a striking force, but she could not do so until all her reconnaissance aircraft were back. Some of the Swordfish coming in to land-on when the stern was rising and falling too quickly had to be waved away three times, and the last pair returned with three minutes' petrol left. The deck control officer had to attach a rope to his waist before he could stand, holding up the "bats" to signal the Swordfish on.

Once the Flight Deck officer had to "strike" the aircraft below after they had been ranged to save them from being blown off the deck. When the last of the striking forces was landing-on, after the *Bismarck* had sunk, a Heinkel attacked the *Ark Royal*, which was in an almost defenceless position, steaming into wind, and unable to use her 4.5 guns, but the fire of her consorts, H.M.S. *Renown* and *Sheffield*, was accurate and drove the Heinkel off with smoke pouring from one engine. The bombs fell 400 yards away from the carrier.

This is only one of the thrilling stories told in this little book. There are many others, and we have seldom come across a better nine-pennyworth.

THE discovery of the fact that a lodestone, or a piece of iron which has been touched by a lodestone, will direct itself to points in a northerly and southerly direction has been attributed variously to the Chinese, the Arabs, the Greeks and the Etruscans. Wherever the credit belongs, however, it cannot be denied that it is only constant application and research which have made possible the precision of the modern Mariner's Compass which contributes so largely to the safe passage of every sea-going vessel. The constructors of those craft which to-day are making new Nautical History likewise base their work on tradition, blended with vigorous enterprise and meticulous craftsmanship.

THE BRITISH POWER BOAT COMPANY LTD.

Constructors of Scott-Paine Surface Craft

PBP

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Twelfth of the New Recognition Series

AIRCRAFT TYPES AND H

Vultee Vengeance and Republic Thunderbolt

PROBABLY no other type of aircraft has occasioned so much lively discussion as the dive-bomber. There have been wild recriminations about our lack of this particular type of aircraft by those who pointed to the early successes of the German Stuka in blasting a way for advancing ground forces, but who invariably omitted to mention that they encountered little or no opposition on those occasions and that whenever the Stuka has come up against a Spitfire or a Hurricane it has been "cold meat."

Questions have been asked in the House on a number of occasions and, after at least one curious example of official contradiction, it ultimately emerged that we actually ordered Vultee Vengeance dive-bombers from America in July, 1940. Other types, however, were more urgently needed, and in the meantime the R.A.F. has found that such fighter-bombers as the Hurricane IIB (the "Hurribomber") have been capable of carrying out their own form of low-level attack with admirable results.

But the dive-bomber, as a specialised design, will soon be numbered among the diverse types employed against the Axis, and both Vultee Aircraft Inc. and the Northrop Aviation Company are now busy producing the Vengeance for the R.A.F., whose standard dive-bomber it is to be.

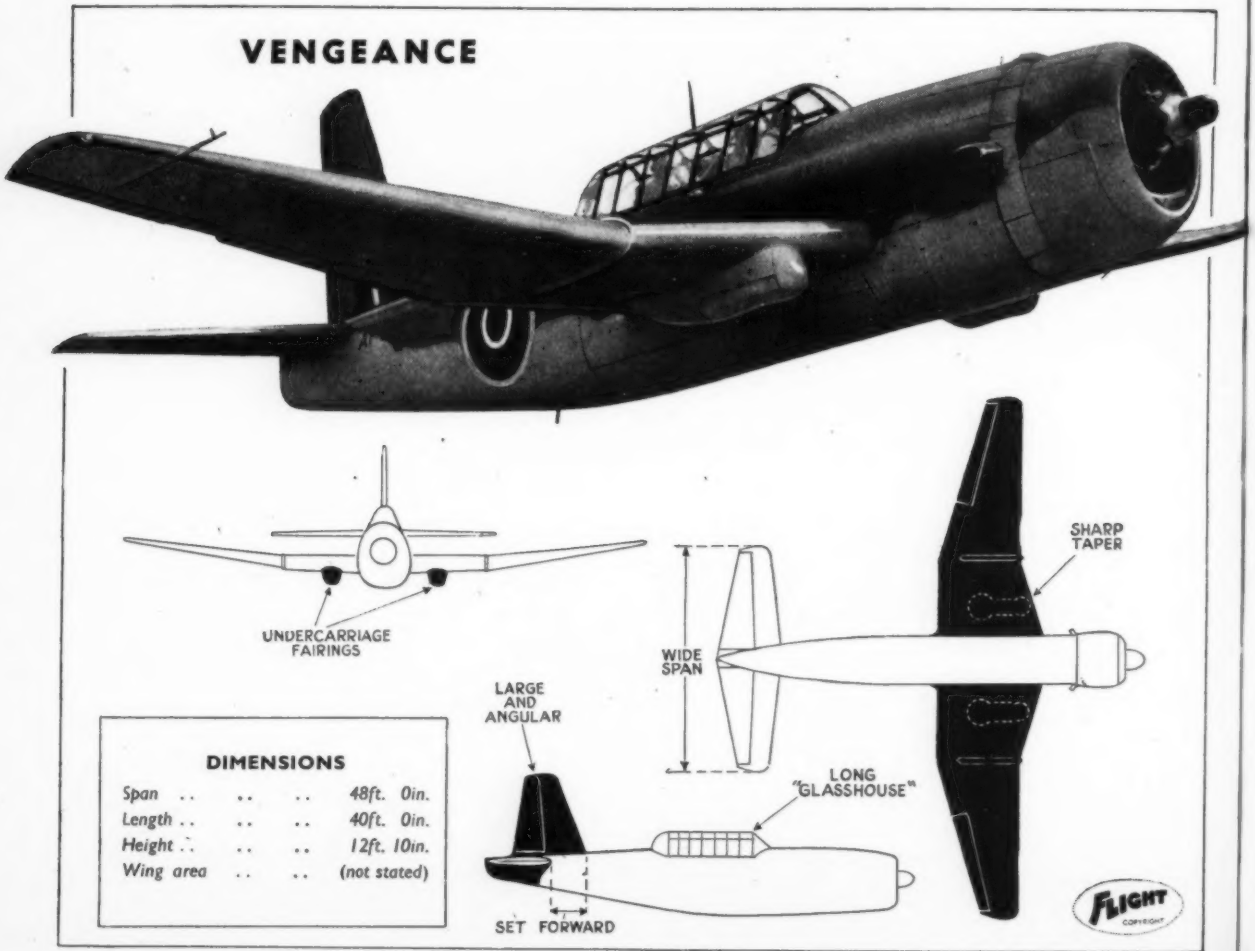
The Vultee Vengeance is a two-seater mid-wing cantilever monoplane of all-metal construction which carries its bombs stowed internally in the fuselage below the floor of the cockpit. It is not yet permitted, however, to publish its bomb load, armament or performance.

It is powered by a Wright 14-cyl. double-row Cyclone GR-2600 air-cooled radial geared and supercharged engine of 1,600 h.p., equipped with a three-bladed c.s. airscrew. Dive brakes are fitted under the outer panels of the wings, whose unusual plan make it easily recognised.

The centre-section, which tapers in section from thick roots, has a pronounced backsweep to the leading-edge and a straight trailing-edge. The outer wing panels, which have a fairly high degree of dihedral, have straight leading-edges and a pronounced forward sweep to their trailing-edges. The optical effect of this combination of plan taper is to give the impression that the outer panels of the wings bend forwards; the effect in perspective, as will readily be seen from the accompanying photograph, is to suggest a slightly cranked wing.

The hydraulically operated undercarriage retracts backwards, the wheels twisting through 90 degrees to lie in recesses in the centre-section; hinged fairings enclose the legs when raised.

A long "glasshouse" cockpit cover and a large, angular fin and rudder set forward in relation to the tapered tailplane are other notable features for the spotter.

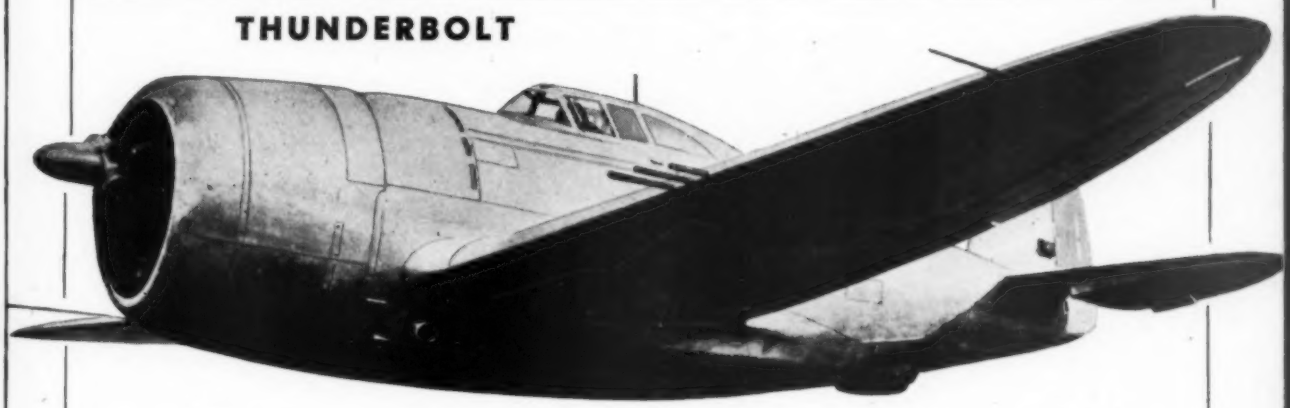


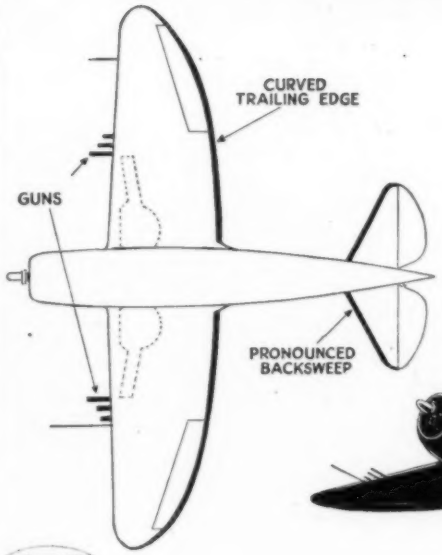
DIMENSIONS

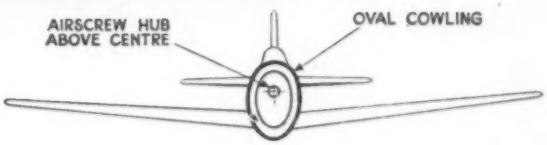
Span	48ft. 0in.
Length	40ft. 0in.
Height	12ft. 10in.
Wing area	(not stated)

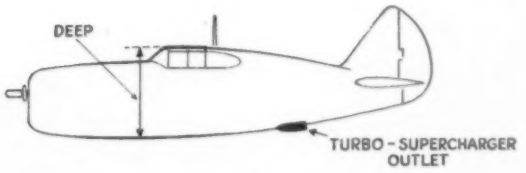
HEIR CHARACTERISTICS

THUNDERBOLT









DIMENSIONS

Span	*41ft. 0in.*
Length	*32ft. 8in.*
Height	*13ft. 0in.*
Wing area	*(not stated)*

FLIGHT COPYRIGHT

POWERED by the Pratt and Whitney 18-cyl. Double Wasp engine of 2,000 h.p., the Republic Thunderbolt (P-47B) is America's fastest and biggest fighter. Official details of its performance, armament, weight and so forth have not yet been released, but American reports credit it with a top speed of more than 400 m.p.h. and a total weight in excess of 13,000 lb. It is known to be heavily armoured, to have bullet-proof petrol tanks, and to carry a powerful armament of large and small calibre guns which very possibly include one or more cannon; the last suggestion is, admittedly, speculation, but in view of the lessons learnt by the R.A.F. and demonstrated by our own fighters, it can be taken as something more than a mere guess.

In large-scale production for the U.S. Army Air Forces the Thunderbolt follows the general layout and constructional features which have proved so successful in previous fighters from the same stable. The Republic concern claim it to be the fastest fighter in the world and, while it is certainly the fastest American fighter to date, we should prefer to be a shade more cautious and credit it with being *one* of the fastest fighters in the world.

As in the case of the Focke-Wulf Fw.190, the choice of an air-cooled radial engine has not been dictated by the belief that this type is preferable to the liquid-cooled in-line engine, but because no engine of the latter type is at present available with a sufficiently big power output. America certainly has in-line engines of the 2,000-plus h.p. category on the way, but they are not yet in production. The big Pratt and Whitney, however, was available in sufficient quantities, and so the choice necessarily fell upon this type, which has an exhaust-driven turbo supercharger to maintain power output at the greatest altitudes at which the modern fighter is being called upon to operate.

To keep down the diameter of the airscrew while still coping with the terrific power output of such an engine, a 12ft. four-bladed airscrew is fitted; this is of the fully feathering type. The cooling gills at the back of the cowling are on the upper half, while the outlet for the exhaust-driven turbo-supercharger may be seen beneath the fuselage aft of the trailing-edge of the wings. Incidentally, the restriction of the airscrew diameter to reasonable proportions, by allowing shorter undercarriage legs to be employed, leaves more room in the centre section for the disposition of armament, fuel tanks, etc.

Recognition features include the curved trailing-edge, small wing-tips, the deep oval section of the cowling, and the turbo-supercharger outlet already mentioned.

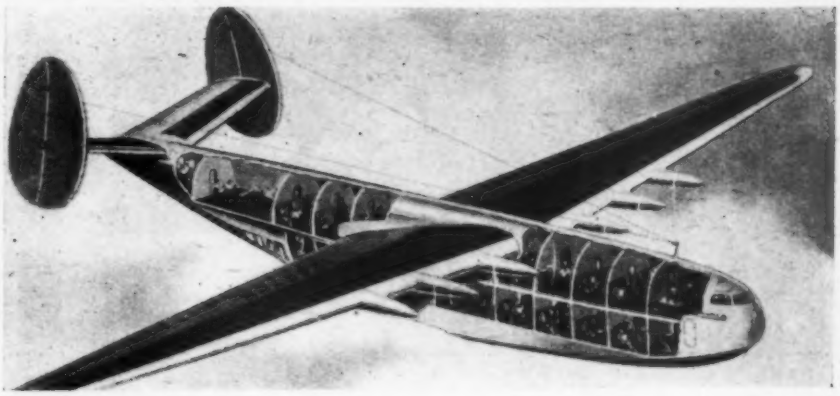
A24

Quality plus Design

SMITH'S
AIRCRAFT
INSTRUMENTS

WE MUST SHIP BY AIR

American Views on Advantages of Air Transport : Speed, Safer Routes, and Huge Savings in Materials



Glenn Martin project for 125-ton "flying ship" designed to carry 100 passengers and 25,000 lb. of mails from New York to London in 13 hours.

"IF I were asked which I preferred, 1,000 bombers or 1,000 transporters, I should find it difficult to decide; I should take advice." In these, or at any rate very similar words, Mr. Churchill, in the House of Commons, answered Members of Parliament who were pressing for transport aircraft. The realisation is spreading that the air will play an ever-increasing part in the conduct of the war, not military aviation alone, but air transport generally. The August issue of *Fortune* contains a sane and closely reasoned article on the subject, from which the following extracts are quoted. Although the article approaches the problems largely from the American point of view, it is not difficult to think of applications to British conditions. —ED.

This vicious problem of pushing munitions out to the fighting fronts and bringing strategic materials in, resolves itself into a question of how to manufacture the most ton-miles in the shortest time from relative investments in man-power, fuel, steel, and other raw materials. Our first attempted solution was instinctive and traditional; ships and still more ships. But obviously ships by themselves are not enough for this war. Fast as we are building, they are being sunk even faster, and as each one goes down there is subtracted from the total American power to wage war a vital fraction of its communications and, in too many instances, an irreplaceable fraction of weapons and supplies required to maintain armed force somewhere in the world. On the sea we have therefore arrived at the margin of frustration. Tanks, guns and ammunition, however miraculously produced, win no battles on the bottom of the ocean. From this predicament the airmen, supported by influential laity, are proposing a bold escape; that we turn to the air at once and develop a fleet of cargo aircraft, even at the cost of cutting into the shipbuilding and combat-aircraft programmes.

Until a few months ago the conception of moving large bodies of men and heavy cargoes by air had little standing in American strategy. In the President's original 50,000-aircraft programme of May, 1940, the proportion of cargo carriers was less than two to every hundred combat aircraft. Moreover, these were mostly intended for limited, short-range tactical use, and they carried the catchall A-10 priority, the same as that enjoyed by aluminium scrap and most maintenance and repair parts, as for trucks.

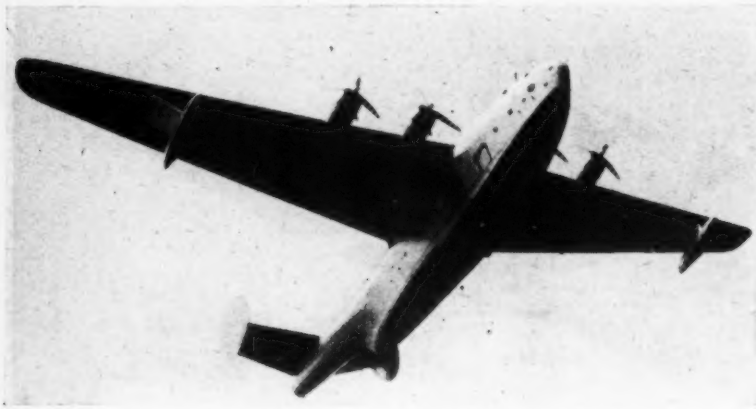
The C-47 is the familiar, seven-year-old DC-3 airliner, with all passenger comforts removed and a big cargo door, heavy floor beams, and folding seats substituted.

Too Many Sponsors

To-day many of the air cargo carriers, especially those intended for long-range ocean hauls, have moved up to the top of the priority list alongside the four-engined bomber. And from having no sponsors at all, except for a handful of supposed crackpots and airline operators tainted by the suspicion of self-interest, the cargo carrier as a war instrument is jeopardised by having too many. The struggle over who shall control this new logistical weapon threatens to develop into a fierce bureaucratic war.

The case for the cargo aircraft versus the ship has gone beyond technical bookkeeping costs. It is beside the point that on a per-ton-mile basis the aircraft is not in the same league with the surface ship—with 10 to 15 cents per ton-mile for the former compared to as little as one-tenth of a cent for the latter. This differential derives primarily from the higher technical skills required to build and operate an aircraft; it is a dollar cost that ceases to be important in war. Therefore, the only realistic basis for comparison is the extent to which the

WE MUST SHIP BY AIR



The Martin 70-ton flying boat *Mars*, 100 of which may be built by Mr. Kayser—if Mr. Nelson decides to release the materials and engines.

aircraft offers a more economical use of raw materials for delivering goods *where they are needed and when*—conditions the ship has manifestly failed to meet. Once this fundamental has been determined, the decision as to how far to plunge on the aircraft can be made.

The time element, as it favours the aircraft over the ship, needs no brief, although few appreciate how far ahead strategic decisions must be laid down in remote areas on the basis of eight-knot convoys. The nine convoys that arrived in Singapore in time for their troops and equipment to be captured by the Japanese, had been laboriously assembled in Australia, India and the Middle East weeks before. In depending upon eight-knot sea-borne transportation, the British and ourselves, at the cost of a succession of disasters, have had to anticipate the strategic moves of the enemy, most conspicuously in the Mediterranean, by at least the five months required to send convoys by way of Capetown. The Germans, on the other hand, by going to 150-mile-an-hour air transportation, have been able, first of all, to create their own strategic situations at will, as in Norway, Crete and Libya; and next, to provide a swift counter to a bad situation, as was done in Russia, when the encircled Sixteenth Army at Kharkov was reinforced and supplied from the air.

Hours Instead of Days

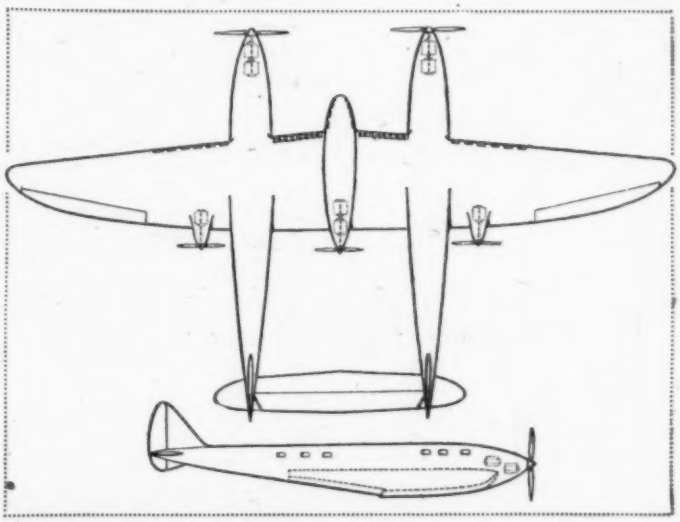
One way by sea, as convoys travel, and allowing for turnaround, it is about 4,100 land miles and thirty-seven days to England; 7,400 miles and two months to Australia; 14,300 miles and five months to India; 12,900 miles and five months to the Middle East; 5,400 miles and five months to Archangel. By air, with carriers now available, and assuming the aircraft are pushed through night and day by relays of crews, it is twenty hours to England, two days to Australia; 10,800 miles and three and a half days to India; 9,400 miles and two and a half days to Cairo; and 11,700 miles and three and a half days to the U.S.S.R., via Khartoum.

To a large extent, war transport is a function of maintenance; in fact, one of the worst tasks ahead is to maintain at the fronts, with replacement parts, the machines we are producing at such immense cost. If they cannot be kept running, it is senseless to continue to chew up materials. Unless the war finally doubles back on us, we shall have none of the grim advantages that accrue to the R.A.F. in England, where the bombers and fighters that assault Germany are based next to the factories that make them. American aircraft are flying to battle stations all over the world. The penalties for not keeping them in flying condition were depressingly evident in Burma, where 100 A.V.G. fighters lay grounded at a critical moment for lack of solenoids—a simple gadget, weighing perhaps two pounds, used in the gun-firing system. And again in the Middle East, where one-fifth of the Allied air force was out of action in the spring for want of spare parts—four months away by sea in England.

In short, if the air cargo carrier did not exist, it would be necessary to invent it, to end the anachronism presented by a 300-mile-an-hour striking force, based thousands of miles from its home factories, but geared to an eight-knot supply line.

The two head engineers of the Douglas Aircraft Co., Messrs. A. E. Raymond and E. F. Burton, who have given intensive thought to the economics of air cargo movement, have made a provocative comparison of the costs in man-hours and raw materials involved in moving a body of troops by air, on the one hand, and by sea, on the other. The problem posed was to move 150,000 troops—roughly ten divisions—2,500 miles in six days. This is equal to the distance from San Francisco to Hawaii, and more than that from Newfoundland to Scotland, or from Brazil to West Africa. By sea it would take fifty standard C-1 transports, making 18.4 miles per hour and carrying 3,000 troops each, to meet the deadline. By air it would take 150 aircraft, cruising at 220 miles per hour with about 167 men and each averaging a daily round trip, to do the same job.

It should be pointed out that the aircraft used in these calculations is still in mockup and, naturally, is many months away from production. The craft is roughly of 140,000 pounds gross weight (weight of aircraft, plus crew, fuel, and payload) and, therefore, about two and one-third times as heavy as the DC-4 (designated C-54 by the Army), Douglas's heaviest aircraft to date. But the per-



A Seversky project of some years ago. It envisaged a twin-fuselage, twin-float seaplane, in which the floats retracted into the fuselages, thus wasting a great deal of the cargo space.

formance estimates of its designers can be accepted as realisable. They arrive at the following comparisons:

	Ship	Aircraft
Number required	50	150
Cost per unit	$1,800,000	$650,000
Total cost	$90,000,000	$97,000,000
Weight of raw materials per unit (in tons)	3,977	36.6
Total weight of raw materials for the task	199,000	5,500
Fabricating man-hours per pound	0.19	2.5
Total man-hours for the task force	60,000,000	27,000,000
Per-pound cost	$0.22	$8.80

Per-pound and man-hour figures for the aircraft based on a production order for 100 aircraft. On the basis of 1,000, Douglas engineers say that the per-pound cost could be reduced at least to $5. But, against the whole war programme, it is the expenditure in critical materials rather than in dollars that is crucial; and here the aircraft, requiring only 3 per cent. as much materials to do the job, represents a spectacular saving over the surface ship. Moreover, the ship figures do not take into account (a) the immense weight of metal invested in the naval escort that such a troop movement would require; or (b) the preliminary industrial process, which consumes three or four times the weight of materials represented by the finished ship. Clearly, we are approaching the end of the tether in the matter of steel for merchant ships, the demands of which are cutting across those for tanks, warships, new plants and the railroads. Any alternative that promises to lift the pressure, as does the cargo aircraft, deserves the most careful consideration.

Yet, as the alternative, the aircraft is not without serious faults. It is itself a consumer of critical materials and critical techniques. Fabricated aluminium has always been tight, and lately the whole aluminium supply has been menaced by the loss of bauxite shipments in the Caribbean. Thus, the air-cargo programme must necessarily be at some cost to the fighter and bomber programmes.

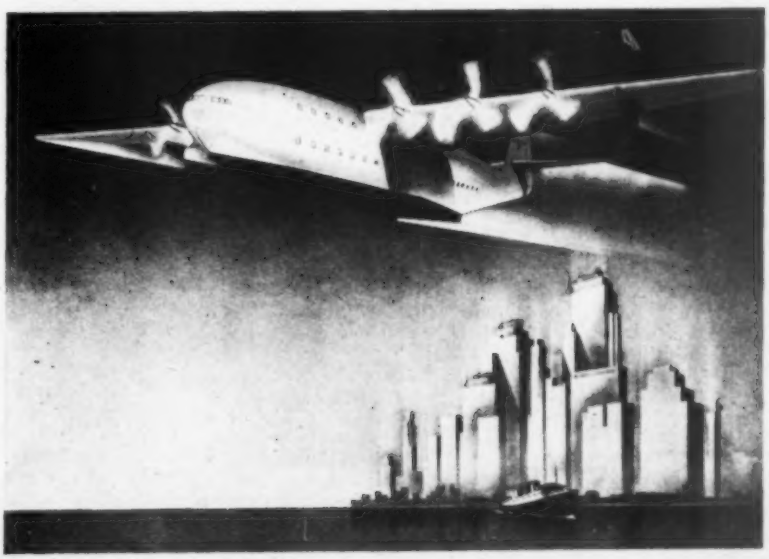
This is the immediate production problem. The operational problems, which will be intensified as the number of air carriers increases, concern (a) the pilot shortage, already acute; (b) the enormous difficulty of maintaining adequate bunker stocks of high-octane gasoline at jungle, desert and mountain bases thousands of miles from refineries; and (c) the responsibility of supplying the considerable ground forces that are being built up in the wastelands along the strategic Great Circle courses of the air. These forces, pioneers of the new air trade routes, are often dependent upon air-borne supplies.

Finally, as air transport rises in importance, an Axis counter must be anticipated. It may come sooner than we think, and in two forms. One would be the appearance of long-range interceptors to prey on the slower, weakly armed merchantmen far out at sea or between land terminals, and to bomb and strafe their landing fields, fuel depots and repair shops. This threat, in turn, would force the development of the aerial convoy; indeed, fighter screens have already been thrown across the most exposed stretches of the new high supply lines. Some losses must be expected, but the advantages should be overwhelmingly with the merchantman, which can choose its time and route, finding refuge in clouds, or making its passage over the more dangerous stretches during hours of darkness. The practical impossibility of maintaining a tight aerial blockade from distant bases has been shown by the success of ferry operations to Britain and the steady reinforcement of Rommel by air from Crete and Sicily.

More dangerous than an Axis counter by air would be a direct attack against the stepping-stones on the strategic air routes. Two such are of acute importance, and both are in jeopardy. One is Alaska, which offers the shortest route to China and Russia. The other is the broiling, sweating stretch of the west coast of Africa nearest Brazil, which provides land bases for the routes across Africa to the Middle East, Russia, India and China. Suppose the Germans were to seize Dakar. From there to Bathurst is only 105 miles—about fifteen minutes for a fighter. The Germans, when it suits their purpose, presumably will make a rush for strategic coastal points. Moreover, the Vichy-controlled air bases that flank the route inland from French West Africa are a threat. The loss of the African route, in terms of the potential of American air power in the Middle East and Asia, would be as catastrophic as the loss of Suez to sea power. For this region is one of the rising strong points of air power—the logical inheritor, with Alaska and Hawaii in the Pacific, and Labrador-Newfoundland on the North Atlantic, of the waning role of the great fortresses of sea power; the equivalent of a new Gibraltar, or Singapore, or a Panama Canal in the strategic geography of the air.

If the present West African coastal bases were lost, new ones could be improvised farther down the coast, perhaps in the Belgian Congo. But the increased distance from Brazil would necessitate heavier fuel loads, which would cut into pay loads. A four-engine, cargo-type air transport, about to enter quantity production, can move five tons of pay load over the existing South Atlantic route. To fly an additional 500 miles to reach a safe base would require 3,000 pounds of gasoline, equal to a 30 per cent. cut in pay load. Three aircraft would then be required to do the work now being done by two.

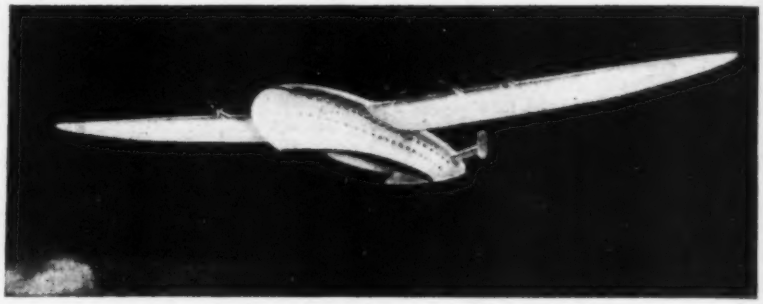
To pursue the evil possibilities farther, suppose the loss of the present African ocean terminals were followed by the loss of the great refineries at Abadan, in the Persian Gulf. With Abadan would go our last source of high-octane gasoline outside the Western Hemisphere. Aside from the enormous difficulties of fuelling a world-wide system by tanker from home, the cold-water fact is that even now there is not enough high-octane fuel to go around. The loss of Abadan would be comparable to the collapse of the middle span in a bridge.



Artist's impression of Boeing's interpretation of a 100-passenger, six-engined clipper-of-to-morrow.

WE MUST SHIP BY AIR

The largest cargo plane now in operation consumes four and a half tons of gasoline, hauling five tons of pay load from Brazil to Calcutta. And, of course, it must have gasoline to return—another four and a half tons or so. Thus, for every ton of pay load carried outbound to the end of the route, the aircraft burns nearly two tons of fuel to fly itself out and back. And, thus, without bunker stocks laid down at necessary depots by other forms of transportation, the cargo carrier cannot operate over this route. The more efficient, longer-range craft on the drafting board should add a small plus to the equation, but these are a long way off, and meanwhile the present effort to supply China from India testifies to the high cost of operations in a region without fuel. Along the dangerous 1,260-mile route from Calcutta to Chungking, which threads the high passes of Tibet, converted DC-3 air liners are obliged to carry 35 per cent. of their pay load in extra gasoline in order to replenish China's lean reserves.



Another six-engined project, the Sikorsky, designed to the same Pan American specification as the Boeing.

Few enthusiasts give the fuel factor much weight in their calculations, but the effectiveness of the cargo aircraft is bound up inseparably with high-octane geography. Its worth to us in this war will be governed by our ability to fuel it and to maintain an unbreakable hold on those bases that it can reach without sacrificing an undue share of its load to gasoline.

Except for this matter of gasoline, the Germans, who have used air transport with fantastic success, have no comparable problems. All Europe is a vast landing field, and for the Germans the longest over-water range for cargoes is the 300-mile jump from Crete to Libya, where Rommel has been steadily supplied by air with troops, fuel, spare parts, ammunition, food, mail, even disassembled fighters.

Four Critical Ranges

Four critical ranges must be spanned in order to reach American and Allied forces on active fronts. There is the 1,850-mile range from Natal, on the hump of Brazil, to the west coast of Africa; the 1,860-mile range from Newfoundland to England; the 2,500-mile range from the mainland to Hawaii; and the 5,000-mile range from Alaska to Chungking. (All ranges are in statute miles.) The first three are most important. If they can be spanned with substantial pay loads, and if meanwhile the enemy does not roll up geography from under our feet, the aircraft offers a thoroughly important, if partial, solution to the logistical dilemma.

Beyond these ocean ranges, the Pacific stepping-stones and the land bridges of Europe, Africa and Asia present a succession of landing fields that can be negotiated by relays of short-range aircraft. China is the major question mark. To the extent that it is being supplied at all, China is being served the longest way around—across the South Atlantic to West Africa, across Africa, India, Tibet into Yunnan Province—16,800 miles from Miami.

The logical path to Chungking is from the railhead at Seattle to Alaska, from there to Yakutsk in Siberia (about 2,400 miles, the longest single jump), and thence across Mongolia into China, in all 5,000-odd miles. The Russians have a "no trespass" across it now, but even were it removed, the maintenance and fuel problem at the Siberian and Mongolian depots would be nearly insuperable. A non-stop flight is, therefore, a desideratum, and if India is lost, an aircraft capable of making it may possibly be the only means of supplying China. Otherwise, for dealing with the first three critical ranges, two types of four-engined landplanes are moving into production. One is the C-54, the militarised version of the Douglas DC-4, of which the prototype was built in 1940-41 for the airlines. It has a gross weight of about 31 tons. The other is the somewhat bigger C 69, a military modification of the famous Lockheed Constellation, also laid down for the airlines, of which the prototype has yet to fly. Either type can double as a troop transport or cargo carrier. However, little can be published about their performance, and data concerning the C-69 especially, an extremely fast, long-range ship, of which the basic design was developed several years ago by Howard Hughes in collaboration with Pan American and Lockheed engineers, is tightly guarded by the Air Force. Both aircraft, however, are capable of spanning the three ocean ranges with considerable pay loads; and while they will doubtless see service all over the world, they will be the main work horses on the important sea shuttles.

For shorter, overland routes two excellent twin-engine types—both converted airliners—are also entering quantity production: the Douglas C-47 and the Curtiss-Wright C-46. The C-47 is the familiar, seven-year-old DC-3 airliner, with all passenger comforts removed and a big cargo door, heavy floor boards, and folding seats substituted. It is the U.S. equivalent of "die gute Tante Ju." (German airmen's nickname for the Junkers Ju.53—ED., *Flight*.) Although the ship has flown to Hawaii with a small load, it is a slow, light (15.5 tons gross weight), short-range aircraft, with an economical speed of 155 to 160 miles an hour and a range of 1,000 to 1,500 miles with about a four-and-a-half-ton pay load. Curtiss-Wright's C-46, first laid down on the drafting boards in 1937, is somewhat faster, heavier (about eight tons maximum gross weight), and carries a bigger pay load (about eight tons over 1,500 miles). Both are also combination troop and cargo haulers and can function as feeders and relay ships for the ocean carriers in this hemisphere and abroad.

With these four types, supplemented at the outset by converted long-range bombers, we should be able to deal with the immediate minimum working ranges. A projection of what could be done with a relatively small investment in existing types of aircraft in a critical theatre of war, under conservative wartime operating conditions, is shown on page 263. Still ahead, however, is the real plunge—on far bigger craft, not in scores but in hundreds. The aircraft's contribution to the solution of the logistical nightmare will increase in proportion as it is able to set up *pay load at range*. Granted that huge aircraft mean tedious and uncertain research. To the cynical phrase that the war will be over before such machines can be finished, the answer is that no man knows when the war will end; it may never end. Mr. Loening visualises a 450-ton aircraft; Glenn Martin says he is prepared to build one of 125 tons. A jump to a mere 70-ton aircraft of the DC-7 type is esti-

(*Continued on p.* 263)

DEVELOPMENT of the VS-300 HELICOPTER

A paper read at the Rotating Wing Aircraft Session of the Tenth Annual Meeting of the Institute of Aeronautical Sciences by I. I. Sikorsky, Engineering Manager, Vought-Sikorsky Division of the United Aircraft Corporation.

EVEN a brief glance at the history of direct lift aircraft reveals that the primary problems that were encountered in this field were those of (1) stability, (2) control, and (3) the smoothness of operation of rotors and of transmission mechanisms.

During the nineteen twenties, however, extensive research and experimentation was carried on by Juan de la Cierva and his associates on the autogyro, which made possible for the first time a practical understanding of many principles of rotating wings, including the famous articulated blades, rotor balance, rotor control, etc. The impulse given by the successful work of de la Cierva, as well as the general progress in aeronautical engineering, finally permitted the successful solution of all main problems connected with the design of a helicopter.

The object of this paper is to describe briefly the general characteristics of the VS-300 helicopter, which was constructed in 1939 and successfully flown during the last two years.

Description of the VS-300

The VS-300 helicopter is equipped with a three-bladed main rotor of 14ft. radius and has a welded tubular steel fuselage and an auxiliary propeller for torque compensation and directional control, rotating in a vertical plane at the tail of the fuselage. During the early part of 1941, a 90-h.p. Franklin air-cooled engine replaced the previous 75-h.p. engine in the aircraft and has supplied the power ever since.

In addition to the torque-compensating propeller, various control propellers have been installed at the tail of the fuselage at various stages of development. During 1941 the tail propellers, including the one for torque compensation, were generally two-bladed with 46in. radii. The main rotor in hovering flight turns about 260 r.p.m., and the tail propeller or propellers turn about five times that speed. A free-wheeling unit is installed between the engine and the rotor drive shafts so that the main rotor and tail rotors may continue to turn in an autorotative condition in the event of engine failure. Power is transmitted by means of a multiple-V-belt drive and bevel gears. The angle of incidence of the main rotor blades is controllable with a range from +2 to +13 deg., and the incidence of the tail rotor blades is controllable and reversible. It is obvious that if the incidence of the main lifting rotor is increased more power will be required for it. Therefore, a means of synchronisation is provided between the main pitch control and the throttle arm of the carburettor so that an increase in incidence will be accompanied by an automatic increase in throttle opening and vice versa.

Flights of the VS-300

The practical results of 1941 are best demonstrated by a brief résumé of the flights made.

During the year several pilots flew the aircraft extensively, and satisfactory flight and control characteristics were demonstrated. The aircraft, without exception, always took off and landed with no ground run whatsoever, regardless of the wind velocity. It could rise and descend vertically or on an inclined plane varying from 0 to 90 deg.; it could hover over one spot for any desired length of time and could be flown backward or sideways as well as forward. In forward flight, speeds upward of 60 miles per hour were reached, although the aircraft did not at any time approach its maximum. Precision control was repeatedly demonstrated by approaching persons or objects on the ground and hovering within inches of a given point, followed either by backing away or by proceeding sideways or forward in a routine manner. One example of this was the changing of a tyre while the aircraft hung motionless just above the ground.

Fig. 1. The VS-300 with two auxiliary horizontal tail-rotors.

During the late summer and fall, the aircraft was mounted on pneumatic rubber floats, and extensive water operations were carried on within a range from 0 to 60 miles per hour, and fast forward flights, sometimes low over the surface of the water, were repeatedly made to demonstrate the accuracy of control. On the surface of the water the aircraft was found to be more easily handled than any other surface vessel. It not only taxied forward and turned as do other surface craft, but it could also be brought to a complete stop without disengaging a clutch or stopping the engine and be taxied backward without using a reverse gear. It could taxi sideways even against a strong current or wind and turn complete circles precisely on one spot. Because of the aircraft's ability to land and take off vertically, there was no problem of spray from the pontoons and no step was required.

During 1941, three important recorded flights were made by the writer as follows:—

On April 15 the VS-300 established the official national helicopter endurance record by remaining in the air 1 hour 5 min. 14.5 sec.

On April 17 the helicopter, mounted on rubber floats, was repeatedly taken off from water and landed on water and then landed on the ground, demonstrating for the first time a direct lift aircraft with excellent amphibian characteristics on which no adjustments whatsoever are needed when going from water to land and vice versa.

On May 6 the VS-300 brought to the United States the official international record for helicopter endurance by remaining in the air 1 hour 32 min. 26.1 sec.

Control with Two Horizontal Tail Outriggers

During the first half of 1941, control of the VS-300 helicopter was secured from two auxiliary tail rotors turning in a horizontal plane; these were in addition to the previously mentioned torque-compensating rotor that turns in the vertical plane (see Fig. 1).

The two horizontal rotors were mounted on welded steel tube outriggers, one on either side of the tail of the fuselage. Each of these outriggers was approximately 10ft. long, and various angles were given to them in order to investigate the advantages to be secured from changing the plane of rotation of the tail propellers in relation to the main rotor disc. These horizontal propellers provided lateral and longitudinal control as follows: (1) lateral control was secured by increasing the incidence of the blades of one propeller while decreasing the incidence of the blades of the other propeller (this was accomplished by moving the conventional pilot's control stick to one side or the other); (2) longitudinal control was secured by increasing or decreasing the incidence of the blades of both

DEVELOPMENT OF THE VS-300 HELICOPTER

horizontal tail propellers simultaneously (this was done by forward and backward movement of the conventional pilot's control stick). This type of control was found to be extremely sensitive and positive under all circumstances and provided almost instant change of attitude of the airship. The inherent stability, however, was not so marked as in more recent control revisions and, obviously, the structure and transmission arrangements were more complex than in later designs. It was with this control that the record flights previously mentioned were made.

Control with One Horizontal Tail Propeller

During the summer of 1941, experiments were carried on with sectional pitch control in the main lifting rotor (see Fig. 2). In this plan the horizontal tail outriggers were removed and each main rotor blade changed its angle of incidence progressively throughout its cycle of rotation. Thus, for instance, with the control stick moved toward the right, all blades would progress to a certain minimum incidence as they passed the right-hand side of the airship, while at the left-hand side all of them would be at a certain maximum incidence. Such an arrangement resulted in inclining the lift vector of the main lifting rotor to the right, thus causing a resultant horizontal force to act.

During the following five months, extensive flights were

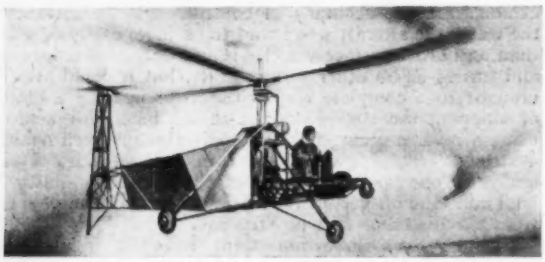


Fig. 2. As flown with sectional pitch control on the lateral axis only.

made with sectional control used on the lateral axis only, and with longitudinal control secured through a tail propeller mounted on a skeleton tower above the tail of the fuselage. The incidence of the blades of this propeller could be increased or decreased at the will of the pilot. This arrangement, shown in Fig. 2, was found to have many advantages, primarily a certain pendular lateral stability and positive longitudinal control. It also had a more simplified structure with its obvious advantages of storage, etc.

Full Sectional Control

During December, 1941, the control arrangements were again revised in order to provide control by sectional change of the incidence of the main rotor blades longitudinally as well as laterally. Thus, the former lateral sectional control was broadened to be effective throughout the entire 360 deg. of the disc of rotation. The horizontal tail propeller, which had previously been used for longitudinal control, was entirely removed, leaving only the torque-compensating propeller at the tail (see Fig. 3). Sectional change of pitch in the main lifting rotor was secured by inclining the conventional pilot's control stick in the desired direction. The first flights with this control were made just before the end of the year and during January, 1942, the new control arrangement was proved to be satisfactory in extensive flights. Various modifications have been investigated, including the installation of a horizontal fin surface at the tail (see Fig. 4). This is now being tried alternately as a movable surface co-

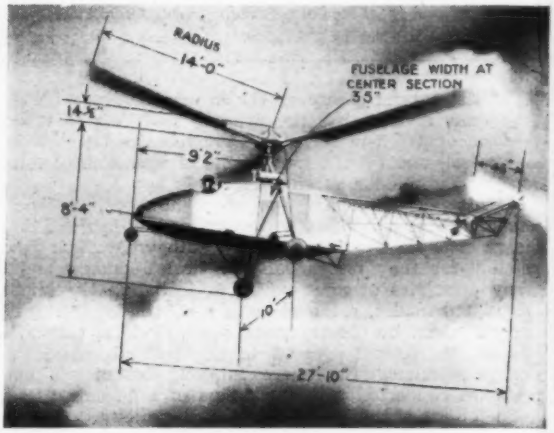


Fig. 3. The VS-300 with only a torque-compensating airscrew at the tail.

ordinated with the fore-and-aft inclination of the main rotor disc and as a fixed surface to act as a stabiliser and a dampener. However, the amount of flying to date with this supplementary surface is not yet sufficient to evaluate fully its worth. Flights with the full sectional control have so far been entirely satisfactory, and the aircraft seems to have reasonable inherent pendular stability, laterally and longitudinally. The obvious advantages of this arrangement are the further simplification of structure and transmission problems.

Directional Control

It has been stated above that the torque-compensating propeller, turning in the vertical plane at the tail of the aircraft, also provides directional control. This is secured through action of the pilot's rudder pedals which change the angle of incidence of the torque-compensating propeller blades, thus increasing or decreasing their thrust. With the rudder pedals in neutral, a few degrees positive incidence is always carried on the blades of this propeller to compensate for the torque of the main lifting rotor.

Action of Main Rotor Blades

By reviewing briefly the action of the main rotor blades, therefore, it is found that in the present full sectional control arrangement their incidence may be varied in two different ways: (1) simultaneous increase or decrease through action of the pitch control lever at the pilot's left hand, which results in increasing or decreasing the thrust of the main rotor and thus controlling the rate of ascent or descent of the craft; synchronised with this is the action of the throttle so as to provide a change in horse-power as required by the change of incidence and maintain a sub-

Fig. 4. The installation of a horizontal fin surface at the tail.

DEVELOPMENT OF THE VS-300 HELICOPTER

stantially constant number of revolutions per minute without the need of manually adjusting the throttle; and (2) progressively throughout the cycle of rotation so that each blade will follow a varying path in relation to normal; this is controlled by the conventional control stick which not only determines the direction of inclination of the main rotor disc but also the degree of this inclination. Thus it is possible in a given condition of flight to have, for example, 9 deg. of incidence on the main rotor blades through action of the main pitch control and then to add or subtract a few degrees at any point in the cycle through action of the sectional control. The sectional control, of course, always works so that the lowest point of the blades in their cycle of rotation is at 180 deg. to the highest point.

In conjunction with the investigation of the three fundamental controls outlined herein, the effect of fuselage covering in various degrees was also studied. Vertical fin area toward the tail of the fuselage was first applied as in Fig. 1; thereafter, the entire side of the fuselage was covered as in Fig. 2; and, finally, a nose covering was installed which provided an open cockpit for the pilot (Fig. 3). As a general rule it was found that a certain amount of fin area made the controls considerably more effective and pleasant but that an excess tended to give too much damping to the action of the controls. The nose covering did not appear to change materially the flying characteristics, and the aircraft is being flown at present with this covering constantly installed.

On the basis of the results achieved with the VS-300 helicopter during the year 1941 in which fundamental problems of control and stability appear to have been solved, the writer looks forward with confidence to the future of direct-lift aircraft. The future work that remains to be done will include the refinement of controls already investigated, as well as research along many other lines of thought. This will doubtless produce further improvement in the handling qualities of the aircraft, but it is certain that 1941 has seen the VS-300 grow from an experimental laboratory model to an aircraft that embodies practical flying qualities.

WE MUST SHIP BY AIR (Continued from page 260)

mated to give a pay load of seventeen tons at 3,000 miles, twelve and a half tons at 4,000 miles, eight and a half tons at 5,000 miles. On a 3,000-mile haul one hundred of them could do the work of 280 of the present C-54s and 880 of the C-47s. In going to bigger, more efficient aircraft, we shall gain in many directions: in the output of ton-miles with respect to the weight of materials invested in the aircraft; in the ratio of flight crew to tonnage moved; and, finally, in the ratio of ground installations to work done in the air.

Two other potentials of the current cargo programme should be kept in mind: gliders and aircraft built of non-critical material. Curtiss-Wright, sub-contracting into the woodworking industry, is building a 30,000-pound plastic-wood aircraft. This craft is expected to have a 600-mile range with six tons at 175 miles per hour. Budd has large orders for a stainless-steel job of about the same weight and range, but reduced pay load. As both are experimental, airmen regard them with caution. Substitution pays no dividends where heavier materials cut into pay load.

As for gliders, a good deal of nonsense has been written about them. The Army has hundreds on order, ranging from two-place trainers to two-ton cargo haulers. Their peculiar importance in cargo operations derives from the fact that an aircraft is theoretically able to tow approximately half its gross weight in a glider. Thus a 25,000-pound DC-3, with four tons in its own cabin, should be capable of pulling six and a quarter tons more in tow, although at greatly reduced speed. The enormous boost to the ton-mile output that the addition of a glider fleet would give to the prime carriers is obvious, but many problems relating to pick-up, crew relief on long flights, and glider behaviour in ice and storm conditions, remain to be solved. A two-ton glider is the heaviest now being built for the Army's cargo programme.

Using Existing Aircraft

The following operation, while based upon data prepared by Pan-American engineers, is entirely hypothetical and has no relation to military movements, current or projected. It is simply a conservative estimate of what could be done with aircraft in existence, assuming reasonable production quantities.

The bottleneck is the 2,000 mile ocean hop from Natal, on the Brazilian bulge, to certain landing areas on the West Coast of Africa. Suppose five Pan-American Boeing Clippers and eight Stratoliners were concentrated on that run.

STAGE I **All weights in pounds**

5 Clippers at 4 round trips each per week = 21,450 per day = 150,000 per week
8 Stratoliners at 5 round trips each per week = 19,300 per day = 135,000 per week
Total .. .. .. 40,750 per day = 285,000 per week

Feeder aircraft required to move this weight from Miami to Natal:

21 DC-3s at 2.75 round trips each per week = 42,500 per day = 297,000 per week

From west coast of Africa to Calcutta (via Cairo):

50 DC-3s at 1 round trip each per week = 40,750 per day = 285,000 per week

STAGE II

Three DC-4s, on through service from Miami to Calcutta, should be able to deliver 20,000 pounds a week = 950 pounds per aircraft per day. Assume this type can be added to the service at the rate of two a week, from August 1st, 1942.

By January 1st, 1943, 44 DC-4s would be available.

41 DC-4s would, therefore, land 42,000 pounds a day at Calcutta
Stage I would meanwhile land 40,000 pounds a day at Calcutta
Total .. .. .. 82,000 pounds a day at Calcutta

If to Khartoum instead:

44 DC-4s would land 83,600 pounds a day
Stage I would land 40,000 pounds a day
Total .. .. 123,600 pounds a day

STAGE III 1942-43

Assume DC-4s added at the date of one a day after January 1st, 1943. By July 1st, 1943, 181 additional aircraft would be available. As of that date, they would be delivering cargo at the rate of:

To Calcutta:

181 DC-4s = 254,000 pounds per day
Plus Stage I and II = 82,000 pounds per day
Total .. .. .. 336,000 pounds per day

By January 1st, 1944:

365 DC-4s = 429,000 pounds per day
Plus Stage I and II = 82,000 pounds per day
Total .. .. 511,000 pounds per day

Or to Khartoum:

On July 1st, 1943, Stage I, II and III = 467,600 pounds per day
On June 1st, 1944, Stage I, II and III = 817,600 pounds per day

THE SUNDERLAND ACCIDENT

Fifteen Lives Lost When Flying Boat Crashed on Hillside

BRITISH aviation suffered a grievous loss when, on August 25th, a Sunderland flying boat which had taken off from its base 60 miles back crashed into a hillside in the North of Scotland, all on board, with one exception, being killed. Among those on board was Air Comdre. H.R.H. the Duke of Kent. The others who lost their lives in the accident were:—

Lt. J. Lowther, R.N.V.R.; P/O. the Hon. Michael Strutt; L.A/C. J. Hales; Wing Cdr. T. L. Moseley (Australian), 1st Pilot; Flt. Lt. Frank McKenzie Goyen (Captain); P/O. S. W. Smith (R.A.A.F.), 2nd Pilot; P/O. G. R. Saunders (Navigator); Flt. Sgt. W. R. Jones; Flt. Sgt. C. N. Lewis; Flt. Sgt. K. J. Hewerdine; Sgt. E. F. Blacklock (R.N.Z.A.F.); Sgt. A. R. Catt; Sgt. L. E. Sweett.

Flt. Sgt. A. S. W. Jack was thrown clear, and although he received injuries he walked three miles through the heather and was found by some crofters who took him to a village and had his injuries tended before going to hospital.

The funeral of the Duke of Kent took place at St. George's Chapel, Windsor Castle, on Saturday last, August 29th. It was attended by the King and Queen, Queen Mary, many members of the Royal Family, the Kings of Norway, Greece and Yugoslavia, and Queen Wilhelmina of Holland. On Sunday, August 30th, a memorial service was held at St. Peter's, Iver, Bucks.

A tribute to H.R.H. the Duke of Kent, and to the devotion of our Royal Family generally to the nation's interests, will be found in a leading article on p. 243. On p. 266 Mr. Griffith Brewer, president of the Royal Aeronautical Society, calls attention to the distressing fact that from the time Cecil Grace was lost in the Channel until the present time, accidents such as that which befell the Sunderland have continued to happen. A difference of a few feet in altitude, or an increase in wind strength which puts the aircraft off its course, and tragedy is the result.

MERCHANT SERVICE OF THE AIR

Mr. Gordon England Thinks in Terms of 5,000 Aircraft

AN address under above title was delivered to the Institute of Export last Thursday by Mr. E. C. Gordon England, managing director of General Aircraft, Ltd. Mr. W. L. Runciman, director-general of British Overseas Airways, was in the chair. Mr. England claimed that geographically Great Britain is the actual centre-point of nearly the whole of the earth's dry land, from which he argued that we must become the hub of the world's merchant service. He pleaded for close co-operation with other nations of our great commonwealth, and suggested the setting up of a Commonwealth Board of Merchant Air Services, each nation represented by an appropriate Air Transport Minister. Mr. England estimated that a fleet of 5,000 aircraft with a useful load of 20 tons, making a round transatlantic trip once every four days, would move 150,000 tons per week in both directions. Such figures gave a new conception of speed in the execution of overseas orders, and a fluidity of movement of passengers and goods undreamt of until to-day.

It may be said that Mr. Gordon England urged many indisputable generalities which have long been widely recognised. Would anyone repudiate his claim that glorious pages of history have been written by Britain's merchant service of the sea, and should be written by her merchant service of the air? Civil aviation, he argued, should be looked upon as something important to the whole Empire. Nobody dissented from his reasoning that prosperity goes hand in hand with activity. We are going to march forward, he asserted, with the sisterhood of this great Commonwealth of Nations.

Principal among the half-dozen who contributed to the discussion were Mr. W. C. Devereux, of High Duty Alloys, Ltd., Sir Alan Cobham, Mr. Theodore Instone, Grp. Capt. Wright, M.P., and the chairman himself. All agreed that the desirability of developing British air transport was undeniable, but Mr. Devereux reminded the meeting of the big engine demands for bombers, and spoke of the ordered pooling of American and British production to the common end of winning the war. Grp. Capt. Wright said that when in the debate on the Air Estimates in 1940 he had pleaded for a mere 150 transport aircraft he had actually been criticised for having an unrealistic view of the prevailing conditions. (Nobody asked him how many Hurricanes he would have exchanged for Ensigns or DC.3s or Flamingos at the time of Dunkirk.) He invited Mr. Gordon England to repeat his lecture to a group of M.P.s interested in the subject.

Against the "Chosen Instrument"

Sir Alan Cobham went so far as to say that air transport was perhaps the most necessary single factor to the survival of the British Empire. He was against the monopoly of the "chosen instrument"—only by trying different lines of development in competition would progress be achieved. Mr. England replied to the speakers, expressing satisfaction that his case had found favour among them. The Hon. W. L. Runciman said that as Director General of British Overseas Airways Corporation he found himself to-day in the difficult position of carrying responsibility without authority.

An article on the vital need for making the fullest use of air transport during the war appears in this issue on page 257 *et seq.*

A PERISCOPE SEXTANT FOR AIRCRAFT

TWO research men of the U.S. Army Air Corps at Wright Field—Carl J. Crane and Samuel M. Burka, of Dayton, Ohio—have been granted a patent covering a sextant designed for mounting in the fuselage of an aeroplane so that it can be trained more quickly and steadily on a star than can a sextant held in the hand. The U.S. Government is granted free use of the patent by the inventors.

With this new type of sextant the navigator takes observations from inside the 'plane by means of a universally rotatable periscope-like tube that projects through the top of the fuselage from the fixed mounting within. Images of stars on which the azimuth and altitude readings are taken are projected by lenses, prisms and mirrors in the tube and focused in the instrument inside the fuselage. The navigator can point the tube to any part of the sky.

The sextant can be used also for measuring in degrees the bearing of a star or an object on the earth with relation to the aircraft in which it is mounted, for measuring drift, and for piloting the 'plane on course.

HERE AND THERE

T.C.A. Progress

TRANS-CANADA AIR LINES carried 10,334 passengers in May, an increase of 713 over the preceding month and 2,211 over May of last year, according to W. F. English, Assistant Vice-President.

The mail load amounted to 166,420lb., an increase of 27,023lb. over April and of 49,826lb. over May a year ago. The express (i.e., "packages") volume, 25,281lb., was the heaviest recorded for any one month to date.

When Sirens Sound

THE Royal Observer Corps, though it renders a multitude of services to the Royal Air Force and to the air defence system of the country, is not responsible for the sounding of air-raid warnings.

Members of the Corps are finding that this is not generally understood, for they are apt to be taken to task by their neighbours when they think that an alert is sounded too late or too early.

The chief duty of the Corps, the majority of whose personnel are civilian volunteers, is to report the movement of all aircraft, both friendly and hostile, which fly over this country. This information, flashed from observer posts to observer centre, is relayed to the appropriate R.A.F. organisation, which, if the aircraft are hostile, initiates the air-raid warning machinery in the threatened areas.

An Old Irish Custom

IRISH Air Lines have a quaint little custom when they open any new route. The aircraft which makes the first flight on such occasions always carries a certain small wooden box marked "First air mail and passenger flight; Dublin-Berlin, 1932"—a relic of Eire's first entry into the field of commercial aviation.

The latest occasion when this "old Irish custom" was indulged was the recent opening of the first internal air route in Ireland—the new Dublin-Limerick service—by a D.H. 89a (Dragon Rapide) express air liner.

Just what this little box contains is not stated in the report reaching us, but one may perhaps be forgiven for regarding it as a sort of wistful token of Eire's neutrality.

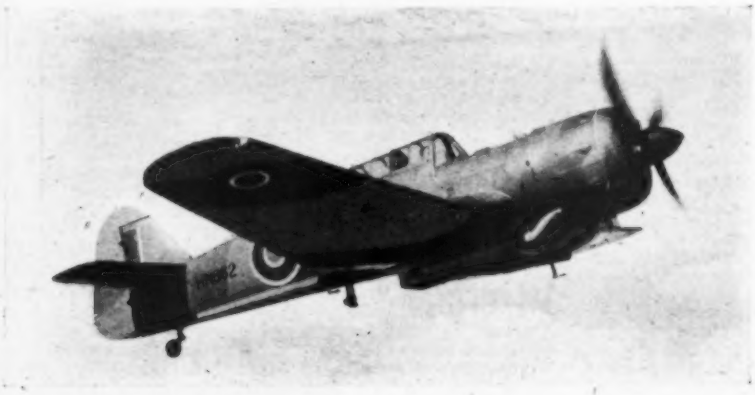
TRANSATLANTIC LANCASTER: This latest example of the British heavy bomber class was flown from England to Canada recently, where it will be demonstrated and then probably go on tour in the U.S.A. On the transatlantic flight the machine set off at an all-up weight of more than 60,000 lb. It was flown by a crew of Ferry Command, who normally deliver American-built bombers to Great Britain. In the group are, from left to right, Sqn. Ldr. Russell Felgate, R.A.F., representing M.A.P.; Ian M. Smith, of Toronto, navigator; Capt. Newton Collins, of Missouri, co-pilot; Clyde Pangborn, of Washington, pilot; G. F. Harvey, of Vancouver, radio officer; and F/O Ian L. Colquhoun, R.C.A.F., of Edmonton, Alberta. F/O Colquhoun belongs to one of the first Lancaster operational squadrons in Great Britain.

More to Come

INCIDENTALLY it seems that the new Dublin-Limerick air service has revived a general interest in Eire in municipal airports, for we learn that Cork, Drogheda (County Louth), Meath, Tralee (County Kerry), Waterford, Sligo and Cobh (Queenstown) are all going ahead with plans for airports including, in the case of Drogheda, a flying-boat base in the estuary of the River Boyne.

Mr. Sean O'Huadhaigh, a director of Irish Air Lines, said at the opening ceremony of the new service that his company would be prepared to operate to other cities in Eire when proper airport facilities were provided, and added that the day was in sight when the company could stand on its own feet without the aid of the present State subsidy.

This reminds us of the very wisecrack of a certain American air expert who defined a commercial airline as one that could support itself in the air financially as well as aerodynamically.



NEW TARGET-TOWER: The Miles Martinet I, Bristol Mercury engine, can be fitted with either wind-driven or electrically driven target winch. It has obviously been developed from the Miles Master.

Shoulder Badges for Colonial R.A.F.

MEN from the Crown Colonies now serving in the R.A.F. may soon be wearing on their shoulders the name of their colony, if suitable arrangements can be made with the various authorities concerned.

This was stated in the House of Commons by Captain H. H. Balfour, Under Secretary for Air, replying to the question whether men from the Colonies could follow the practice adopted for men from the United States and Canada.

Captain Balfour also announced the introduction of a new badge for flight engineers—the men who keep the multi-engine aircraft in flying trim. The new badge is to be a single wing with the letter "E," and will be worn on the left breast like the air-gunner's winged "A.G.," which badge it resembles.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

INTERNATIONAL AIR CONTROL

Carriers versus Floating Islands

THE articles "Torpedo Aircraft" and "International Air Control" in *Flight* of July 30th seem to me to be closely linked by two widespread misconceptions. First, as the aircraft becomes less and less of a lone wolf freak in war, so its rôle must devolve to that of a really practical, very long range or high altitude gun. Secondly, accepting the principle that the authority controlling such aircraft should be chosen according to the operational base, all the disadvantages of carrier-borne aircraft would disappear with the use of the floating islands advocated from many quarters for many years.

Further consequences of such adjustments would, of course, be the end of the capital ship controversy, and the splitting-up of the short-lived Third Service, which has done so much to energise our war machine by its unfettered youth. The International Police argument, in favour of a separate air force, seems to me about as practical as a police station bristling with howitzers to keep order in a city, without the use of patrolling constables. I recognise, however, that this view is dependant on the classification of aircraft as very practical guns, and therefore I have made only two points.

"GROUNDED FAIRY."

FLEET FIGHTER PERFORMANCE

Speed versus Manœuvrability

IT is more than a little puzzling to read the following paragraph, taken from the booklet *Ark Royal*, which was published by the Admiralty recently: "The Italian torpedo aircraft would attack most gallantly, particularly in the beginning of the operations, flying in tight formation and coming in among the ships only a few feet from the surface of the sea. Their losses were consequently very heavy; during one attack they lost eighteen out of thirty-six aircraft by action of the Fulmars and by gunfire of the Fleet. Italian fighters, Fiat C.R.42's, accompanied the bombing formations, and although they usually kept beyond range of the warships' guns, their superior speed accounted for several of the Ark's Fulmars.

There must be something wrong when a second-rate fighter like the C.R.42 is apparently superior to our best naval fighter, even considering that the Italian machine has the advantage of being land-based.

Also, according to various reports, the top speed of the Fulmar is, if anything, better than that of the Fiat and there is no question as to which has the better armament.

The explanation is more likely to be that the Fiat C.R.42's exceptional manœuvrability gave it a decisive advantage. It is therefore evident that in fighter aircraft good manœuvrability, even at a slight sacrifice in speed, is worth half a dozen or so machine guns.

This point accounts for the Italians' love of highly manœuvrable fighters with, to us, absurdly inadequate armament.

J. H.

CADET UNIFORMS

A.T.C. and U.A.S. Anomaly

I WOULD like to make a contribution to the correspondence which has appeared from time to time in your columns about University Air Squadrons and the A.T.C. Under the present circumstances University Air Squadron cadets wear a regular R.A.F. uniform but with A.T.C. buttons and shoulder badges, while the A.T.C. cadets have to wear a uniform with a closed neck.

This system is fair to neither. On the one hand, Air Squadron cadets, practically all of whom are already attested to the R.A.F. Volunteer Reserve, whose squadrons are run entirely at Air Ministry expense, and whose training exempts them from the R.A.F. Initial Training Wing, are confused with the A.T.C., which is a junior institution, supplying pre-entry training for the R.A.F., paid for partly, it is true, by A.M., but mostly by local youth funds.

On the other hand, the A.T.C. cadet sees the University Air Squadron cadet wearing A.T.C. insignia, and yet wearing collar and tie, and he is consequently liable to a feeling of inferiority or resentment at what he considers an unjust distinction. Both parties are in consequence resentful and dissatisfied.

What are we going to do about it? It is no good giving the University cadet a plain A.T.C. uniform, as was once suggested in your columns. That would merely make matters worse from his point of view. The only thing to do is to break completely the half-hearted liaison between the two bodies and, if the Air Ministry is adamant in its refusal to grant the use of R.A.F. insignia to cadets who are, after all, already in the Air Force and doing R.A.F. training, some new individual form of buttons and badges for the University Air Squadrons must be developed. It should, for example, be fairly easy to produce brass buttons with the R.A.F. eagle, but without the crown. It does, however, seem foolish that such a contingency should arise at all. The University Senior Training Corps, for example, most of whose members are not even attested, allows its cadets to wear full Army uniform with no restriction.

It is time that the anomalous position of University Air Squadrons be clarified, for at present nobody is satisfied.

U.A.S. GRADUATE.

THE PERSISTENCE OF ERROR

Peril of Under-estimating Wind Speed

IT is disturbing to read that the Duke of Kent when flying to Iceland should meet his death by the aircraft crashing into a mountain only 1,000ft. high. The pilot would, of course, know of the existence of the mountain only 60 miles from his starting point, and the fact of flying low enough to contact at 1,000ft. suggests either that he thought he was flying high enough to be well above 1,000ft., or that he was flying on a course which would allow ample margin for error.

There have been so many accidents due to insufficient allowance for the strength and direction of wind taking an aircraft off its course that one wonders that, after a lapse of more than 30 years since Cecil Grace was lost in the North Sea by not allowing sufficient margin for error in his estimate of the strength of the S.W. wind, this fruitful cause of disaster should continue.

Pilots with old flying experience have paid time after time for this under-estimate of the wind speed. New machines in the last war were delivered straight into the German lines because of their under-estimate of the effect of the tail wind when flying to France, and machines on the Atlantic Ferry have been surprised into the realisation, in some cases too late, of the effect of wind in changing the land-fall after the last observation.

In commercial flying these errors are eliminated by flying on the beam, but in war, for obvious reasons, this facility is denied to Service machines which in spite of their high speed are still influenced by strong, unexpected winds introducing errors which in poor visibility may have fatal consequences.

The solitary survivor in the tail of the machine reminds one of a similar instance of the tail position saving one occupant during the last war when the great H.P. machine went into a spin on its initial flight. Colonel Ogilvie was in the tail and was the only survivor. The late Secretary of the Royal Aeronautical Society, B. G. Cooper, was amongst the remainder who were all killed.

GRIFFITH BREWER.

FROM OTHER LETTERS

IN reply to the letter from A. T. N. Blacker published in *Flight* of August 20th, under the heading of "The Modern Amazon," in which the writer suggested that women should be allowed to train as fighter-pilots, John Darlington, of Sedgley, Worcs., expresses the opinion that aerial fighting is a man's job and questions if a woman could stand up to the physical and mental strains involved. Russian women, he adds, are noted for exceptional toughness engended by their way of life, but 90 per cent. of British women would find it beyond their powers.

Service Aviation

Some of the hundreds of fighter pilots who put up the air umbrella over Dieppe when the big raid was carried out.

Royal Air Force and Fleet Air Arm News and Announcements

Awards

Fleet Air Arm

THE KING has been graciously pleased to approve the following awards for bravery and enterprise while serving on H.M. Ships, Transports and Royal Fleet Auxiliaries in the successful operations which led to the surrender of the important base of Diego Suarez.

DISTINGUISHED SERVICE CROSS.

Prob. Temp. Sub.-Lt. (A) H. H. ALEXANDER, R.N.Z.N.V.R.;
Sub.-Lt. (A) J. WALLER, R.N.V.R.
Act. Temp. Sub.-Lt. (A) R. T. WOLFE, R.N.V.R.

Flt. Lt. R. E. Kirkby, of No. 150 Squadron, who has been awarded a Bar to his D.F.C.

DISTINGUISHED SERVICE MEDAL.

Petty Officer Airman T. L. CRIDLAND.
Act. Petty Officer Airman R. J. K. GROVES.
Air Artificer, 4th Cl., A. BENNETT.

MENTIONED IN DESPATCHES.

Lt. (A) C. H. ANCIL, R.N.
Lt. (A) C. C. TOMKINSON, R.N.V.R.
Sub.-Lt. (A) J. A. POWELL, R.C.N.V.R.
Temp. Sub.-Lt. (A) R. J. GRANT-STURGIS, R.N.V.R.
C.P.O. Air Fitter (A) J. VEITCH.
C.P.O. Airman H. J. LAMBERT, D.S.M.
Air Artificer 4th Cl. F. K. ADAMS.
Air Artificer 4th Cl. L. G. SHORT.
Flt. Sgt. W. S. SIMPSON, R.A.F.

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED FLYING CROSS

P/O. J. G. ELDRIDGE, R.A.F.V.R., No. 103 Sqn.—P/O. Eldridge is a cool and skilful navigator. He has at all times shown the greatest keenness for operations. Unperturbed by the fiercest opposition which has often been encountered, his efficiency has been mainly responsible for the safe return of his aircraft. One night in April, 1942, during a low-level attack on a target near Paris, his aircraft was severely hit by light anti-aircraft fire, throwing it temporarily out of control. The aircraft lost height down to 500 feet and was repeatedly hit. During the episode, P/O. Eldridge, by his coolness and disregard of danger, set a splendid example to the remainder of his crew.

P/O. R. FAIRCLOUGH, R.A.F.V.R., No. 76 Sqn.—P/O. Fairclough has proved himself to be a bold and skilful navigator. He has participated in attacks on a wide range of enemy targets, including Berlin, Mannheim, Hamburg, Brest, and many other highly defended areas. His courage and devotion to duty have been of a high order.

P/O. B. H. D. FOSTER, R.A.F.V.R., No. 12 Sqn.—In March, 1942, this officer participated in an attack on Essen. Whilst over the target area intense opposition and searchlight activity were encountered. During his first run over the target at 12,000 feet, P/O. Foster's aircraft was held in a cone of searchlights. He successfully avoided the beams, however, and again attempted to attack from 8,000 feet, but the bombs hung up. Undaunted, P/O. Foster made a third run at 4,000 feet, and the target was bombed from this height. His aircraft was hit by anti-aircraft fire in eight places. He possesses a fine fighting spirit, and always displays the greatest determination when attacking his allotted target. He has participated in attacks on Kiel, Hamburg, Bremen, Poissy and Rostock.

P/O. A. GEORGE, D.F.M., R.N.Z.A.F., No. 115 Sqn.—P/O. George is an outstanding captain. He has at all times endeavoured to reach his allotted target and press home his attack. On a recent occasion his aircraft was damaged by anti-aircraft

Air Marshal T. L. Leigh-Mallory, on whose shoulders fell the responsibility of organising the air side of the Dieppe raid. Over 3,000 sorties were carried out in one day.

SERVICE AVIATION

fire whilst over Essen. The main fuel-feed pipeline was fractured, and, although temporary repairs were carried out by various members of his crew, fuel was being lost at the rate of one gallon per minute. Despite this, P/O. George skilfully and determinedly flew the aircraft to this country and landed safely, although his petrol was practically exhausted. This officer has participated in raids on Stettin, Bremen, Poissy, Rostock, Warnemunde, among many other important enemy targets. His leadership and courage have been outstanding.

P/O. D. H. T. McRAE, No. 88 Sqn.—P/O. McRae, during the invasion of the Low Countries and the Battle of France, took part in sorties against bridges and against enemy troops and tank concentrations. Following the collapse of France he has been engaged in a number of sea and other patrols. Throughout a long and distinguished operational career this officer has proved himself to be an observer of high courage and first-class ability. On three occasions he has had to navigate his aircraft back to England with one engine completely useless.

P/O. J. G. A. MAGUIRE, No. 226 Sqn.—In April, 1942, P/O. Maguire was the navigator-bomb aimer in the leading aircraft of a formation of Boston bombers which attacked the airfield at Morlaix. He successfully navigated the formation to the target area and directed the bombing run on to the objective. During the latter part of the run up to the target considerable anti-aircraft opposition was encountered, but in spite of this P/O. Maguire directed the release of bombs with steadiness and accuracy, so that all fell within the dispersal areas on the east side of the airfield. This officer has taken part in numerous operational flights. His operational career has included both the difficult and hazardous operations of the Battle of France and the period of the intense daylight offensive undertaken during the Summer and Autumn of 1941. Since his re-appointment to his squadron as bombing leader he has completed a number of further sorties, in each of which he has taken his place as navigator and bomb aimer of the leading aircraft. This keen and courageous officer has always displayed the greatest devotion to duty and a high degree of skill at his work.

P/O. A. G. McP. SUTHERLAND, R.A.F.V.R., No. 106 Sqn.—This officer is a navigator of outstanding ability. He has attacked his targets with consistent success. Apart from other sorties, he has participated in attacks on the Renault factory near Paris and on Lubeck; he has also taken part in three attacks on Rostock. Throughout, this officer has been a model of steadiness, accuracy and skill.

P/O. J. K. TETT, R.C.A.F., No. 103 Sqn.—P/O. Tett has acted as captain of aircraft on many occasions. His ability to make instant decisions in an emergency, his skilful piloting and his cool judgment have set a high standard of morale in his crew. He has participated in attacks on a wide range of important enemy targets, including Cologne, Berlin, Brest, Wilhelmshaven, Rostock and many others. Early in his operational tour, when flying as second pilot, P/O. Tett's aircraft came down on the sea. P/O. Tett acted with great presence of mind, and greatly assisted his captain. During the thirteen hours which the crew were obliged to remain in their dinghy, this officer was a great source of encouragement to all. One night in April, 1942, during a raid on Essen, the port engine of his aircraft failed just before reaching the target. Despite this, P/O. Tett continued his mission and bombed the objective. Flying on one engine, he completed the return journey of some 250 miles, and landed safely at a base in England, without damaging the aircraft or injuring any of his crew. His airmanship on this occasion was of a high order. In spite of several trying experiences, this officer's enthusiasm for operations remains undiminished.

P/O. L. G. A. WHYTE, R.A.F.V.R., No. 10 Sqn.—This officer has performed much excellent work. One night in April, 1942, he participated in a bombing attack on the German Naval Base at Trondheim. Whilst over the target area an intense concentration of anti-aircraft fire was encountered. Undeterred, P/O. Whyte dived through the barrage to make a low attack. The operation was repeated the following night, and again he pressed home his attack from a perilously low height in the face of shattering enemy fire. This intrepid captain's operational career has been characterised throughout by high intelligence and resource.

W/O. E. F. W. PINNEY, No. 420 (R.C.A.F.) Sqn.—W/O. Pinney has participated in attacks against many of the highly defended and important enemy targets such as Hamburg, Essen, the Renault works near Paris, Lubeck and Rostock. He is a skilful pilot who carries through his allotted task with great coolness. He has set a splendid example to the less experienced members of his squadron.

Act. Flt. Lt. O. H. COEN, R.A.F.V.R., No. 71 (Eagle) Sqn.—Since December, 1941, this officer has participated in many operational sorties over enemy occupied territory, during which he has destroyed one enemy aircraft, assisted in the destruction of another and damaged several more. Flt. Lt. Coen has at all times displayed courage, devotion to duty and leadership of a high order.

P/O. W. J. GREGORY, D.F.M., R.A.F.V.R.—This officer has taken part in the destruction of six enemy aircraft at night. He has shown great skill and devotion to duty.

P/O. C. B. MORTON, R.A.F.V.R., No. 12 Sqn.—One night in July, 1942, this officer was captain of an aircraft detailed to attack Wilhelmshaven. When nearing the target area his aircraft was attacked by an enemy fighter. The port petrol tank was pierced and both gun turrets were put out of action, while the automatic pilot and the inter-communication system were rendered unserviceable. Undeterred, P/O. Morton, although himself slightly wounded in the left leg and suffering pain, flew on to the target, which he bombed successfully. He then skilfully flew his damaged aircraft back to base and, in spite of a burst tyre, made a successful landing without further damage. Throughout this officer displayed great tenacity, endurance and courage.

Act. F/O. D. F. MACINTYRE, R.C.A.F., No. 35 Sqn.
P/O. I. HEWITT, R.A.F.V.R., No. 35 Sqn.

One night in April, 1942, F/O. MacIntyre and P/O. Hewitt were captain and navigator respectively of an aircraft detailed to carry out a low level attack on the German naval base at Trondheim. The target was located and, in the face of intense opposition from the enemy's ground defences, the attack was pressed home with great coolness and determination from a low level.

During this operation the aircraft was hit. The outer portion of the wing caught fire, and the fuselage and cockpit were filled with smoke. Soon the aircraft was well alight, and as it became uncontrollable F/O. MacIntyre decided to descend on to a lake, to which he was directed by P/O. Hewitt. This he achieved by a feat of superb airmanship. The crew then manned their dinghy and made their way to the side of the lake.

After a perilous journey, and suffering great hardships, F/O. MacIntyre and his crew eventually reached England. The greatest credit is due to both these officers for their calm efficiency and courageous devotion to duty.

Act. F/O. N. A. BENNITT, R.A.F.V.R., No. 15 Sqn.—As captain of aircraft, this officer participated in an attack on the submarine slipways at Lubeck. In spite of adverse weather and heavy opposition from the ground defences, he pressed home his attack from a low level. F/O. Bennitt has completed many operational sorties, and has at all times displayed great courage and determination to accomplish his tasks.

Lease/lend in reverse. American ground staff servicing English Spitfires lent to the U.S. Army Air Forces for operational duties.

P/O. W. A. SHOEMAKER, R.C.A.F., No. 15 Sqn.—This officer captained an aircraft detailed to attack the submarine slipways at Lubeck. Despite bad weather and strong opposition from the ground defences, he attacked his objective from a height of only 500 feet. He also directed the fire of his gunners on searchlight positions and machine-gun posts, several of which were put out of action. P/O. Shoemaker has invariably set a high standard of skill, determination and courage.

Wing Cdr. K. J. MELLOR, No. 150 Sqn.—This officer is an exceptional leader, whose skill and devotion to duty have set an extremely high standard. He has acted as captain of aircraft on numerous operational sorties, during which important targets have been attacked both in Germany and German-occupied territory. By his excellent work he has contributed materially to the repeated successes of his squadron.

Act. Wing Cdr. J. H. NEWBERRY, No. 18 Sqn.—This officer has taken part in attacks, often from a low level, on enemy airfields, shipping and industrial targets. On one occasion he led a formation of aircraft in an attack on the iron works at Ymuiden. The bombs caused much damage to the works buildings. He also took part in a low-level attack on the airfield at Herdla. On February 12th, 1942, he led a section of bombers in an attack on the *Scharnhorst* and *Gneisenau* at sea. Wing Cdr. Newberry is a fine leader, who inspires confidence in all who fly with him. Since assuming command of the squadron he has rendered excellent service in forming, organising and training it.

W/O. W. H. GOLDSTRAW, No. 207 Sqn.—Although the majority of his targets have been in the most heavily defended areas, W/O. Goldstraw has maintained a very high percentage of successful sorties. His cheerfulness and resource under the most trying conditions have proved of the greatest value. He has attacked such targets as Berlin, Kiel, Rostock, Stettin, Brest and Essen.

W/O. W. NICHOLLS, No. 7 Sqn.—This officer has always displayed courage and determination in pressing home his attacks; he has also obtained some very good night photographs of the target. Among many other sorties he has made a daylight attack on the German cruisers at Brest. W/O. Nicholls is a most reliable captain of heavy bomber aircraft.

W/O. G. W. SCHOON, R.A.F.V.R., No. 150 Sqn.—W/O. Schoon is employed as captain of aircraft. He has completed his operational tasks with great skill. His excellent judgment and determination, frequently in the face of strong enemy opposition, have set a good example. During the combined services operation against the docks at St. Nazaire, W/O. Schoon attacked his objective from 5,000 feet. Other targets he has attacked include Cologne, Brest, Mannheim, Stuttgart and Essen. He is a most tenacious pilot.

Act. W/O. F. H. MYLREA, R.C.A.F., No. 102 Sqn.—W/O. Mylrea has been engaged on flying operations since August, 1941. He is a navigator of exceptional merit and has at all times displayed the greatest keenness and utmost determination to bomb the target. By careful planning with his captains and attention to detail before a sortie and his coolness and skill during the operation he has contributed materially to the successes obtained. He has taken part in attacks on such targets as Bremen, Essen, Berlin, Wilhelmshaven, Brest and other highly defended areas. His courage and determination have set an excellent example.

Act. W/O. W. C. VANEXAN, R.C.A.F., No. 57 Sqn.—W/O. Vanexan is an extremely capable operational pilot. The majority of his sorties have been against heavily defended targets and have all been pressed home with vigour. One night in May, 1942, he captained an aircraft detailed for a mine-laying operation. The area selected was defended by several armed ships, fire from which damaged his aircraft as well as wounding the rear gunner. Despite this he flew on at 800 feet and placed his mines in the correct position. Although his damaged aircraft was difficult to control he flew it safely back to this country. W/O. Vanexan has invariably displayed courage and devotion to duty.

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. E. BULLOCK, No. 115 Sqn.—On the way to attack Bremen one night in June, 1942, the aircraft in which Flt. Sgt. Bullock acted as wireless operator was attacked by an enemy aircraft and serious damage was sustained. Despite this, while standing in the astro-dome, he gave explicit directions as to avoiding action, which resulted in the enemy being driven off and damaged. Later, when over the target, Flt. Sgt. Bullock's aircraft was further damaged, and the loss of petrol made it unlikely that they would be able to reach this country. Flt. Sgt. Bullock rendered invaluable assistance in obtaining data to enable the navigator to steer the straightest course for base. He also manipulated the petrol cocks, and for the last half hour of the journey held open the nacelle fuel cock so that petrol might flow to the engines. It was, no doubt, due to his special knowledge of the petrol system, and the assistance he gave, that the aircraft returned from this hazardous flight. Flt. Sgt. Bullock has proved himself to be both resourceful and courageous.

Flt. Sgt. J. E. BUTTON, No. 7 Sqn.—Flt. Sgt. Button has served as a wireless operator with efficiency, enthusiasm and skill. He has set an excellent example of coolness and courage in numerous sorties, including two daylight attacks on the German battle cruisers *Scharnhorst* and *Gneisenau*.

Flt. Sgt. G. H. COLES, R.A.F.V.R., No. 207 Sqn.—This airman pilot has completed a number of hazardous sorties in most difficult weather. He

is a sound, reliable and determined captain who is keen to perform operational flying.

Flt. Sgt. F. K. EVANS, No. 57 Sqn.—Flt. Sgt. Evans has completed all his sorties with the greatest enthusiasm, vigour and determination. A skilful and courageous navigator, whose sterling work on operations has been outstanding, he has contributed very largely to the success of his crew under the most trying conditions.

Flt. Sgt. R. A. FLETCHER, R.A.F.V.R., No. 97 (Straits Settlements) Sqn.—In an attack on the Heinkel works at Rostock, Flt. Sgt. Fletcher pressed home the action from a low level, obtaining hits on the works. He has set an extremely high standard of ability and determination as captain of aircraft.

Flt. Sgt. S. D. GOOK, R.A.F.V.R., No. 76 Sqn.—Flt. Sgt. Gook has proved himself to be a first-class wireless operator. He participated in a raid on Berlin, and in a daylight raid on the cruisers at Brest. He also participated in the attacks on the German naval bases at Trondheim on 27th and 28th April, 1942. In addition to his uniformerly fine operational work, he has rendered great service to his squadron in training less experienced wireless operators. He is a brave and skilful man of strong character and high courage.

Flt. Sgt. R. W. STOREY, R.A.F.V.R., No. 207 Sqn.—Since July, 1940, this wireless operator air gunner has participated in numerous attacks on most highly defended areas in adverse weather conditions. His personal skill and resource have materially assisted in the success of sorties to Berlin, Hamburg, Kiel and Brest.

Flt. Sgt. F. J. SWEENEY, No. 61 Sqn.—Flt. Sgt. Sweeney is a most reliable wireless operator. He has shown a keen and determined spirit throughout, and his courage and devotion to duty have been exemplary.

Sgt. R. W. BLAYDON, No. 9 Sqn.—Sgt. Blaydon was the front gunner of an aircraft which attacked Turin. On the night of 7th September, 1941, he flew in an aircraft detailed to attack Berlin. When over Bievelt the aircraft encountered intense flak and was severely damaged. Sgt. Blaydon gave invaluable aid to the pilot, informing him of the directions and heights of the shell bursts, and enabled him to identify Munster, which was bombed, as an alternative target. There were holes in the petrol tanks, but the aircraft reached this country. Sgt. Blaydon's determination, efficiency and infectious cheerfulness have set a splendid example to the other members of his crew.

Sgt. D. T. BONE, No. 18 Sqn.—Sgt. Bone participated in an attack on a tanker off Tripoli in December, 1941, when, despite strong defences, a hit was obtained on the engine room of the tanker. In a low level attack on Castelvetrano airfield in Sicily, Sgt. Bone's sub-formation alone accounted for 15 enemy aircraft destroyed on the ground, out of a total of 44 destroyed by the whole formation. He is a courageous, determined and capable pilot, who is devoted to duty and does consistently good work. Almost all his sorties were completed from Malta.

Sgt. H. G. CAWDRON, No. 9 Sqn.—Sgt. Cawdron was the wireless operator-air gunner in an aircraft detailed to attack Hamburg one night in the winter of 1941. When over the estuary of the Elbe one engine failed and the captain set course for base. Sgt. Cawdron rendered valuable service in obtaining navigational data thereby ensuring the return of the aircraft to this country. On landing it crashed and caught fire, Sgt. Cawdron being injured. Despite this experience he was participating in operations again in April, 1942, and his zeal and efficiency were in no way diminished. He is a most capable and eager wireless operator, who has often volunteered to go as a gunner in order to take part in an operation. On one occasion he rendered invaluable assistance when his aircraft was returning to base on one engine by maintaining pressure on the rudder bar for about an hour and a half. This airman has set an example of the highest order.

Sgt. A. H DURINGER, No. 150 Sqn.—Sgt. Duringer has consistently displayed a strong sense of duty and a determination which has inspired a high standard of morale in the crew in which he is wireless operator. He is keen and able, and his unusual initiative and resource have been a great asset in the completion of many successful sorties.

Sgt. B. BARLEY, No. 101 Sqn.—This pilot has overcome considerable opposition from enemy night fighters when over well defended targets, and by skilful piloting has always brought his aircraft back to base. Possessed of persistent determination, his personal example of good leadership has set a standard of the highest order, and has created a fine team spirit in his crew.

Sgt. G. W. GOULT, No 226 Sqn.—When in action against an enemy convoy Sgt. Goult, by cool and accurate fire, forced an enemy aircraft to break away, and it was shortly afterwards destroyed. During an operation in October, 1941, Sgt. Goult was attacked by four enemy aircraft, but as a result of steady and accurate fire from his guns, one dived away from the action belching a trail of smoke. His high courage, coolness and resource, and his determination to destroy the enemy, have been in a great measure responsible for the splendid offensive spirit of the crew with whom he flies.

Sgt. F. JENKINS, No. 57 Sqn.—Sgt. Jenkins is an outstanding navigator. In the air he has shown courage, initiative and skill of the highest order, and in operations against the most heavily defended targets, his sense of duty and calmness in moments of stress have led to the great success achieved by his crew.

For German stirrup pump practice. An R.A.F. armourer checking and fusing 30-lb. incendiary bombs.

Sgt. K. O. LAW, R.N.Z.A.F., No. 150 Sqn.—In April, 1942, when in combat with an enemy aircraft over the North Sea, Sgt. Law's aircraft was seriously damaged and set on fire. By skill and coolness he evaded the attacker, and enabled his crew to get the fire under control. He flew the aircraft back to base and made a perfect landing in the dark with wheels retracted. Thus, by his calculated handling of his aircraft both he and his crew escaped from a most perilous situation. Sgt. Law possesses commendable courage and he has a fine record of achievement won by exceptional fearlessness in the face of danger.

Sgt. B. LLEWELYN, No. 101 Sqn.—On the night of 25th April, 1942, on a sortie to Rostock, this pilot's aircraft was much damaged in combat with two enemy aircraft, and the rear gunner was dangerously wounded. It was owing chiefly to Sgt. Llewelyn's skill and courage that the aircraft was brought back safely. He is a reliable and competent captain of aircraft, whose determination and resource is particularly accentuated when abnormal difficulty is encountered.

Sgt. D. T. PITMAN, No. 61 Sqn.—Sgt. Pitman, a highly valued member of his crew, has shown skill and courage which have contributed materially to the success of their operations. While at a low altitude he returned the fire from an enemy armed ship. His devotion to duty has been exemplary.

Sgt. C. W. TOWNSEND, No. 9 Sqn.—When acting as rear gunner in a low level attack on Warnemunde on the night of May 8, 1942, Sgt. Townsend informed the captain of numbers and directions of searchlights and light flak bursts. His information was of the utmost value in deciding the direction and amount of evasive action necessary. On return, Sgt. Townsend gave a detailed and accurate description of the damage. His vigilance and observation are much above the average, and on numerous occasions he has sighted enemy fighters when some distance away. An excellent, conscientious and most hard working rear gunner, he has gained the confidence of all those with whom he has flown.

Sgt. J. H. WALKER, No. 18 Sqn.—Whilst in Malta Sgt. Walker completed many operational sorties against targets in Southern Italy and against shipping in the Mediterranean. He flew in a formation which bombed an enemy convoy of three vessels escorted by eight destroyers in the Gulf of Sirte. Despite a terrific barrage, Sgt. Walker pressed home his attacks. One motor vessel was sunk. On another occasion he participated in an attack on a tanker and destroyer in the Bay of Navarino, Greece. The approach was made along valleys lined with high mountains, through severe rainstorms, and in conditions of bad visibility. Direct hits were made on the tanker which was left in flames. A most determined and courageous pilot, Sgt. Walker has done consistently good work, and has shown devotion to duty over a long period.

Sgt. N. J. WARFIELD, No. 142 Sqn.—In a recent low level attack on Lubeck, Sgt. Warfield was heavily engaged by the ground defences and forced down to a height of only a few hundred feet. Undeterred, he pressed home his attack with outstanding skill, and though his aircraft was damaged in many places, he completed his task and returned to his base safely. This airman can be relied upon to press home his attack to the centre of the most heavily defended target. His zest for operations and unfailing cheerfulness, combined with his natural qualities of leadership and his ability as a pilot, make him an invaluable member of an operational squadron.

Roll of Honour

Casualty Communiqué No. 149.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—Sgt. G. W. M. Archer; Sgt. L. Beck; Sgt. P. H. Benson; Sgt. R. Bertram; Flt. Sgt. W. A. C. Browne; W/O. D. F. Corfe; Sgt. J. C. Dean; Flt. Sgt. R. Dunn; Sgt. J. Gledhill; Flt. Sgt. S. E. Howroyd; P/O. K. C. Killoran; Sgt. J. G. Quin; Sgt. G. E. Scales; Sgt. H. A. W. Sewell; Sgt. S. B. Shaw; Sgt. H. J. Stone; P/O. R. Stringfellow; Sgt. F. G. White.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. V. G. Dennis; Sgt. E. Gouldon; Sgt. K. Nisbett.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. L. A. Angel; Sgt. R. A. Baddeley; Sgt. N. Coatesworth; Sgt. D. W. Cockburn; Sgt. R. W. Ebsworth; Sgt. M. J. Fitzgerald; Sgt. G. J. W. Fleming; Sgt. I. A. Flower; Sgt. H. J. Groom; Sgt. S. C. Herbert; Sgt. J. M. Horley; Sgt. N. Kaby; Sgt. H. L. Loveday; Sgt. M. H. McDonald; Sgt. F. G. W. Roberts; Act. Flt. Lt. H. R. Shuttleworth; Sgt. E. A. Spicer.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. A. J. Pratley.

WOUNDED OR INJURED IN ACTION.—Sgt. T. D. D'Arcy; Sgt. E. Debenham; Sgt. C. Gibson; F/O. H. K. Gunnis, D.F.C.; Flt. Sgt. J. L. Lawler; Sgt. W. C. McCoy; Sgt. R. H. Pender; Sgt. W. Wildey; Sgt. J. B. Wilkes; Sgt. J. H. H. Williams.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. P. Ashun; Sgt. F. C. Banks; P/O. J. F. Beckett, D.F.M.; Flt. Sgt. C. T. T. Brady; Sgt. M. W. Buckley; Sgt. W. Drake; Flt. Lt. N. A. Gidney; Flt. Sgt. R. S. C. Goddard; Sgt. R. P. Griffiths; Sgt. J. H. Hackett; Sgt. A. J. Harrison; P/O. D. Hudson; Sgt. J. B. Kehoe; Sgt. D. C. King; Sgt. D. D. Lowcock; Sgt. I. T. Lucas; Flt. Lt. D. H. McArthur, D.F.C.; P/O. J. G. Mackinnon; Sgt. E. H. March; Sgt. R. D. Moss; P/O. I. R. J. Perkins; Sgt. P. A. Rhoden; P/O. R. A. Swann; Sgt. R. B. Trustram; Sgt. G. W. Tull; Sgt. L. D. Walker; P/O. J. E. Wardman; Sgt. D. F. Williams; Flt. Sgt. D. R. Wilson.

MISSING.—Sgt. H. Abbott; P/O. R. G. Addis; Sgt. J. S. Almond; Sgt. R. S. Andrews; Sgt. S. W. G. Avent; P/O. L. P. Bales; Sgt. J. McD. Cameron; Sgt. O. L. Clubb; P/O. W. L. Croxton; Sgt. G. A. Dale; Act. Flt. Lt. D. P. Drussell; Sgt. S. E. Eades; Sgt. A. I. Fone; P/O. R. W. Fox; Sgt. A. C. Gasson; Sgt. A. J. S. Gillespie; Flt. Sgt. F. J. Golightly; Wing Cdr. J. A. G. Gordon; Sgt. E. Graham; Sgt. J. S. Grieve; Act. Flt. Lt. C. P. T. Halliwell; W/O. L. Harrison; P/O. K. F. Harvey; Sgt. N. C. Hayes; Sgt. D. R. Holland; Sgt. A. J. Hyde; Sgt. W. J. Jewell; Sgt. T. J. J. Lyons; Sgt. D. Macdonald; Sgt. W. J. Mills; Sgt. J. Munro; Act. W/O. T. J. Mycock, D.F.C.; Sgt. G. K. M. Newman; Sgt. H. E. Noble; Sgt. G. T. Owen; Sgt. A. D. Saint; Sgt. B. G. Seagoe; Flt. Sgt. W. Shelley; Sgt. A. E. Simmans; Sgt. W. G. Smith; Sgt. L. J. Rollinson; Sgt. R. D. Stevenson; Flt. Sgt. D. W. Taylor; Sgt. J. L. Tolnie; Sgt. A. Wearmouth; Sgt. H. F. V.

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Whenway; Sgt. F. T. Williams; P/O. L. H. Williams; Sgt. A. C. R. Wilson.

KILLED ON ACTIVE SERVICE.—Sgt. J. Anderson; Sgt. G. C. Edwards; Sgt. I. McN. Ferguson; Sgt. L. F. Fisher; Flt. Sgt. J. L. Gibby; A/C.2 F. S. Goodwin; Sgt. A. G. Graham; Sgt. J. E. Gurney; P/O. J. L. Haggerty; L.A/C. M. Hislop; Sgt. J. E. Hough; Sgt. A. T. Howell; Sgt. L. R. Hulme; F/O. F. J. Joshua; A/C.1 C. G. C. Keighley; Sgt. G. Kenworthy; A/C.1 T. Mahady; Flt. Sgt. W. Mair; Sgt. G. Marks; Sgt. H. F. Neary; A/C.1 J. R. Needham; Sgt. B. Nicholls; Sgt. R. O'Keefe; Sgt. E. J. Spencer; Sgt. H. Swales; Sgt. A. Taylor; Sgt. C. R. Whitworth; Sgt. W. R. Willis; Flt. Sgt. G. H. Wilsher.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sqn. Ldr. T. G. Pace.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. E. Dingley; Sgt. L. Durham; F/O. J. J. Gale; A/C.2 P. M. Gillett; Sgt. J. E. Kent; P/O. A. C. Monahan; Sgt. R. A. Morgan; Cpl. J. R. S. Reid; A/C.1 A. Robertson; Sgt. H. B. Wilson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.2 E. D. Balaan; Flt. Sgt. S. Tackley.

DIED ON ACTIVE SERVICE.—L.A/C. A. H. Abbots; Cpl. H. Bishop; L.A/C. D. W. A. Buckingham; L.A/C. C. A. Cook; A/C.1 J. S. Dick; L.A/C. J. Dodds; A/C.1 P. W. Dorey; Cpl. H. Gibbons; Flt. Sgt. A. B. Gordon; A/C.1 R. A. Hackett; Cpl. R. Harvey; Flt. Lt. A. E. Hek; Flt. Sgt. E. R. Johnson; Cpl. T. B. Laird; Cpl. W. A. Mendham; L.A/C. S. Rayner; Wing Cdr. C. A. Redley, D.S.O., M.C.; L.A/C. L. G. Strachan; Sgt. C. Timmis; Sgt. R. White; A/C.1 E. Wingeatt.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 J. D. Baker; A/CW.1 M. I. Bunting.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. K. Aird; Sgt. J. St. L. Baldwin; F/O. J. G. Cowan-Hunt; Sgt. M. J. Daly; P/O. I. H. G. Davies; Sgt. F. B. Dobson; Sgt. R. A. G. Halliday; Sgt. H. A. Jackson; Sgt. F. Mantle; Sgt. G. L. Mustoe; Sgt. R. C. Peverill.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. M. A. G. Howsan.

MISSING.—Sgt. A. W. Greer; Sgt. G. R. Harlock; Sgt. P. C. Hay; Sgt. H. A. McLennon; Sgt. F. J. G. Nell; Sgt. A. R. Travers.

KILLED ON ACTIVE SERVICE.—Sgt. H. B. Crocker; Sgt. M. D. Duggan; P/O. R. H. Frith; Sgt. L. V. S. Henderson; Sgt. J. R. Hoskins; Sgt. J. M. Knight; Sgt. T. A. Krome; Sgt. W. G. Lewis; Sgt. V. R. Pascoe; Sgt. W. A. Robson; Sgt. H. H. J. Rohrlach; Sgt. B. R. R. Rutherford; Sgt. L. Trunley; Sgt. A. R. Whitington; Sgt. W. L. Williams; Sgt. S. D. Wills; Sgt. T. A. Worley.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. I. J. W. Edwards.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. J. W. A. Bustin.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. O. H. Burchell; Flt. Sgt. J. M. Cluff; Flt. Sgt. D. Moss.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. M. C. Howe; Flt. Sgt. R. O. J. Page.

MISSING.—P/O. J. W. Arthurs; Sgt. J. G. Donoghue; Sgt. W. C. Francoeur; F/O. P. C. Jones; Flt. Sgt. A. E. Ross; P/O. L. G. Macleod; Sgt. J. E. Meyer.

KILLED ON ACTIVE SERVICE.—Sgt. R. D. Cook; Sgt. J. M. Charbonneau; Flt. Sgt. D. R. Cox; Sgt. G. L. M. Mesheaw; P/O. P. J. A. H. Palin; Sgt. J. M. Sadler; P/O. F. F. A. Wood.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. S. A. Noyes.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. R. D. Shuman.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. R. J. Grenfell; Flt. Lt. D. J. Haydon; Sgt. R. F. Lander; Sgt. N. Mitchell.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. O. W. J. Bishop; P/O. T. E. Cooper.

WOUNDED OR INJURED IN ACTION.—Sgt. H. E. A. Price.

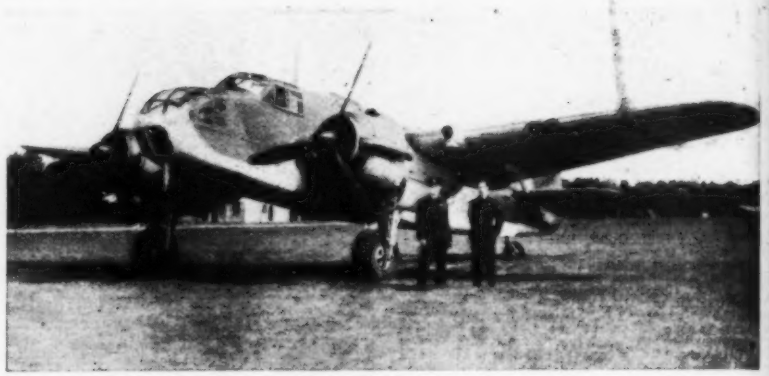
MISSING.—Sgt. T. B. Ainger; Flt. Sgt. D. F. Clifford; P/O. M. C. De Clifford; Sgt. E. C. Inder; Sgt. W. G. Mutton; Flt. Sgt. W. St. G. R. Wilson.

KILLED ON ACTIVE SERVICE.—Sgt. D. Callaghan; Sgt. R. E. Herbert; Sgt. M. Wilkinson; Sgt. J. S. Williams.

South African Air Force

KILLED IN ACTION.—2/Lt. J. H. Heald.

KILLED ON ACTIVE SERVICE.—Lt. V. G. Bissett; 2/Lt. R. Bolton; Air Sgt. T. J. Curtis; Air Sgt. E. Wells.



A Beaufort and crew of the R.A.F. Film Production Unit. All phases of the work of the R.A.F. in war are being photographed.

Casualty Communiqué, No. 150

Royal Air Force

KILLED IN ACTION.—P/O. G. W. Allan; Sgt. A. F. Bolton; Sgt. H. W. Brayshaw; Sgt. W. J. Culbert; Sgt. J. G. Fry; Flt. Sgt. H. Haggas; Sgt. C. Handley; Sgt. M. M. Hazell; Sgt. S. Matthews; P/O. A. G. Merritt; Sgt. A. Rae; Sgt. T. L. Roberts; Sgt. L. Wagstaffe; Sgt. H. L. Watkins.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. S. Brandt; Sgt. R. W. Forman; Sgt. R. T. Morris; Sgt. R. T. Quilter; Flt. Sgt. J. H. L. Thompson; Sgt. R. H. J. Winter.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. M. G. Bloomfield; Sgt. L. Griffiths; Sgt. J. Howett; P/O. R. H. Likeman; F/O. J. Paterson; Sgt. R. Smith; P/O. F. C. Taylor; P/O. C. Thomas.

WOUNDED OR INJURED IN ACTION.—Sgt. M. L. Lawrence-Smith; Sgt. H. Marshall; Sgt. J. W. T. Purdy; P/O. K. N. R. Sissons; Sgt. I. M. Thomas; Sgt. A. H. Williams.

MISSING, BELIEVED KILLED IN ACTION.—P/O. F. W. Belton; Sgt. W. MacD. Crane; Sgt. P. R. Herbert; Sgt. W. E. Hollowell; Sgt. G. W. Hough; Sgt. W. A. McDonnell; Sgt. B. L. Nesbitt; Sgt. R. D. Olver; Sgt. W. J. Phippen; P/O. H. J. S. Sturgess; Sgt. R. J. Thomson; Sgt. A. S. Urquhart; Sgt. G. C. Williams.

MISSING.—Sgt. J. L. Abson; Flt. Sgt. D. E. C. Adams; Sqn. Ldr. M. R. Atkinson; Flt. Sgt. D. H. Baddeley; P/O. B. F. Ball; Sgt. P. W. Barrett; Sgt. W. Bennett; Sgt. H. Bloor; P/O. L. A. Booth; Sgt. R. H. Brett; Sgt. A. L. Brooks; Flt. Sgt. R. F. Carroll; Sgt. I. P. Clark; Sgt. R. Coates; Flt. Sgt. G. Cobden; Sgt. W. Cobell; Sgt. E. Corns; P/O. V. P. De Wallens; Sgt. E. R. Douglass; Sgt. L. R. Dye; P/O. L. C. Edwards, D.F.M.; Sgt. L. R. Elvin; Sgt. R. T. Fage; Sgt. R. W. Fisher; Sgt. J. A. Fraser; Flt. Sgt. F. G. Fry; P/O. J. Graham, D.F.M.; P/O. W. F. B. Griffiths; Sgt. R. G. Gumbley; Flt. Sgt. B. Guy; Sgt. J. Hatch; Sgt. G. Hazan; Sgt. S. F. Hazelton; Sgt. D. V. Howes; Sgt. J. F. Howes; Sgt. H. H. Hudson; Sgt. H. Humm; P/O. H. Inglesby; Sgt. I. James; Flt. Sgt. H. H. Jordan; P/O. A. J. Kenny; Act. Wing Cdr. D. A. Kerr, D.S.O.; Flt. Sgt. G. J. Kerrigan; Sgt. R. Ketchell; Sgt. H. G. Kingston; Sgt. G. Lake; Sgt. J. S. Leather; Flt. Sgt. I. G. I. Lewis; Flt. Sgt. R. E. Little; Flt. Lt. W. M. Livingston; Act. F/O. G. Maclagan; Sgt. J. R. Mason; Act. F/O. H. G. B. Mays; Flt. Sgt. S. E. H. Morgan; P/O. P. Morris; Flt. Sgt. A. J. Neil; Sgt. A. B. Norman; Sgt. J. M. D. Oliver; F/O. D. O. Osborne; Sgt. F. C. Pearman; P/O. P. J. N. Robinson; Sgt. K. G. Rogers; P/O. W. C. Samuel, D.F.M.; Sgt. A. J. Selby; Sgt. J. T. Shapcott; F/O. A. Sharples; Sgt. R. H. Smith; Sgt. W. T. Smith; Sgt. J. J. Southern; Sgt. G. S. Standring; Sgt. R. H. Stanghan; Sgt. D. T. Stanners; Sgt. L. Starbuck; Sgt. R. D. Steer; Flt. Sgt. J. R. Stein; Flt. Sgt. J. Storey; Sgt. E. R. Taxeira De Mattos; Sgt. W. Waller; Sgt. L. M. Washer; Flt. Sgt. A. R. Watkins; Sgt. H. H. Watson; Sgt. V. O. Weston; P/O. F. W. A. Westcott; F/O. K. D. Whisken, D.F.C.; Sgt. D. J. White; Flt. Sgt. D. G. Williamson; Sgt. R. C. Williamson; Sgt. J. P. S. Worling; Flt. Lt. K. B. Wright.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. G. B. Amery; P/O. H. Bunyar; Sgt. S. Counsell; Sgt. Cunningham; Flt. Sgt. R. E. C. Ebsworth; Sgt. D. McDonald; A/C.1 P. C. Rose; Sgt. P. E. Thompson; Sgt. G. R. Waters.

KILLED ON ACTIVE SERVICE.—Sgt. J. F. Anderson; Wing. Cdr. A. F. R. Bennett; P/O. T. J. Brady; P/O. R. H. Broadley; L.A/C. J. C. Campbell; L.A/C. N. Clark; A/C.1 C. B. Clarke; Cpl. G. Cruickshank; Sgt. L. A. J. Dobie; Sgt. J. Elliott; A/C.2 E. Everall; Sgt. J. E. Goodrich; Sgt. R. Greaney; Sgt. J. B. Hall; Sgt. E. Hannath; Sgt. A. Hogg; P/O. T. M. Horsfall; L.A/C. J. H. Johnston; A/C.1 H. Lapish; A/C.2 A. A. Liddington; P/O. N. J. Lloyd; Sgt. J. D. Lowney; Sgt. G. I. McBoyle; Cpl. B. H. Nichols; Sgt. R. L. Norris; Sgt. B. F. J. Page; Sgt. R. T. Pierson; Sgt. K. Potts; Sgt. C. I. Scott; Sgt. J. Smith; Sgt. H. G. Thurgar; P/O. W. T. Vlaato; Sgt. J. R. Warren; L.A/C. J. A. Wild.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. O. Arkell; L.A/C. E. W. Bolton; Cpl. K. E. Chambers; F/O. H. M. Coffin; A/C.2 W. Dent; L.A/C. L. G. Elderfield; L.A/C. L. C. Fitch; Sgt. H. Hastings; L.A/C. G. W. Jackson; A/C.1 F. Loake; P/O. J. Patrickson; Cpl. J. D. Peacock; Flt. Sgt. J. Shannon; Cpl. F. Short; A/C.1 E. Smith; Cpl. H. L. Sparks; L.A/C. B. M. Stephenson; L.A/C. H. Tasker.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.1 G. E. G. Meyrick; L.A/C. J. Portelli; Cpl. A. J. Thomas.

DIED ON ACTIVE SERVICE.—Cpl. T. Carling; F/O. R. A. Clough; L.A/C. E. D. East; Flt. Sgt. E. M. Fletcher; A/C.1 J. W. Hall; A/C.1 C. Kerr; Sgt. J. C. Lyall; A/C.2 D. E. Mair; A/C.1 S. A. Pilbrow; Sgt. F. J. Rigby; A/C.2 S. J. E. Wade; L.A/C. S. D. Thurston.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. J. E. Sheridan; Sgt. M. W. Stanley.

WOUNDED OR INJURED IN ACTION.—Sgt. E. H. East.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. L. A. Davies; Sgt. A. A. Weir.

MISSING.—Sgt. A. N. Blackley; Sgt. R. H. D. Calder; Sgt. J. B. Coppin; Sgt. G. R. Ferguson; Sgt. E. L. Hynd; Sgt. F. J. Irvine; Sgt. R. Mc. G. Laurie; F/O. G. R. Lind; Sgt. D. H. McIntosh; Sgt. J. G. O'Sullivan.

KILLED ON ACTIVE SERVICE.—P/O. J. J. Allen; Sgt. J. L. Allison; Sgt. J. D. Henning; Sgt. E. F. Hunt; Sgt. J. L. Jones; P/O. A. J. Leslie; Sgt. V. J. Pither; P/O. R. W. Rollason; Sgt. A. H. Stephens; Sgt. R. A. Von Der Groeben.

DIED ON ACTIVE SERVICE.—Sgt. J. L. Walker.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Lt. W. L. Cameron; Flt. Sgt. R. A. A. Chalmers; Sgt. T. B. G. Finlay; Sgt. W. A. McCann.

MISSING.—W/O. R. F. Bradbury; Sgt. H. A. Clarson; Sgt. P. J. Fernie; P/O. F. L. Flynn; Sgt. A. B. Harper; Sgt. G. D. Klarner; P/O. B. A. McKenzie; Flt. Lt. J. A. Ridley; Flt. Sgt. W. Tait; Flt. Sgt. R. W. Veit; Sgt. I. R. Watson.

KILLED ON ACTIVE SERVICE.—Sgt. W. T. Gale; P/O. R. S. Horswill; F/O. S. W. Jamieson; Sgt. J. E. Ratigan.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. G. S. Bolton.

MISSING.—Sgt. G. Booth; Sgt. D. W. Cross; P/O. J. R. Farrow; Sgt. R. H. Higgins; P/O. N. R. Holmes; Sgt. J. B. Larkins; P/O. R. V. N. McKay; F/O. J. B. Monro; Flt. Sgt. C. J. Stirling; Sgt. P. R. West.

KILLED ON ACTIVE SERVICE.—Sgt. S. Armory; Sgt. K. A. Hendry; Sgt. F. G. Shears; P/O. W. Twentyman

South African Air Force

MISSING.—Lt. E. C. Anderson; Lt. J. Beasley.

KILLED ON ACTIVE SERVICE.—2/Lt. C. I. Castle; 2/Lt. K. D. Fuller; Air Sgt. G. P. Joned; Major J. Lucas; Air Sgt. A. R. Taylor; 2/Lt. J. S. Warden.